SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXII.—No. 9. [NEW SERIES.] NEW YORK, FEBRUARY 27, 1875. [$3.20 per Annum, Postage prepaid.

THE ENGINEERING WORKS THROUGH, UNDER, AND OVER THE BERGEN HILLS, OPPOSITE NEW YORK.

From a point about opposite the central portion of New York city, for a distance of some fifteen miles northward, the west shore of the Hudson river presents an unbroken bluff, hundreds of feet in precipitous hight, and to which the name of the Palisades has long since been given. The formation is a narrow ridge, sloping gently inland until it reaches the peninsula included between New York Bay on the east and Newark Bay on the west, where it changes into a series of irregular hills. These no longer line the river bank, but, at about a mile from the shore, rise abruptly from the otherwise level country, forming a rocky spine, which gradually tapers, and finally becomes lost in the waters which bound the southernmost end of the peninsula. The geological nature of the rock is a greenstone trap, bordered in places with, and having beneath it, an argillaceous red sandstone, besides containing, in many localities, deposits of iron pyrites.

On the flat plain, east of the ridge, Jersey City is built. The small adjacent towns which, quite recently, were absorbed within the corporate limits of their larger neighbor, lie to the north and south, spreading over the hills, until their westward growth meets a check in the broad expanse of salt meadows and marshes which extend from the foot of the declivity toward Newark Bay. The great railroads, however, which make Jersey City their terminus—the Delaware, Lackawanna, and Western, the Erie, the Pennsylvania Central, and a number of others which include some of the largest coal and oil transportation lines in the country—find little difficulty in crossing the wide flats which form so serious an obstacle to the enlargement of the city. True, the ground is marshy and soft; and in one instance, we learn that, in building the roads, three heavy piles were driven in one above the other before hard, holding soil was reached; but by dint of immense expanses of trestlework and heavy foundations, comparatively solid road beds have been constructed. The great barrier between New York and the inland traffic of New Jersey and Pennsylvania lies in the huge ridge to which we have above referred. Toward the surmounting of this obstacle an aggregate of engineering skill and of capital has been directed, which, considering the small area upon which such vast operations have been conducted, is perhaps without parallel elsewhere in the world. It is our object, in the following lines, to sketch briefly the results of these labors, which may be classed, first, into means for getting over; second, into means for getting under; and third, into means for getting through the hilly. To these we add short reference to another important engineering work, the Jersey City Reservoir and its conduit pipes, which, though not coming under any of the above heads, are nevertheless included within the narrow area over which the other operations have been carried on—a space measuring about two miles and a quarter north and south, and varying in width from half to three quarters of a mile.

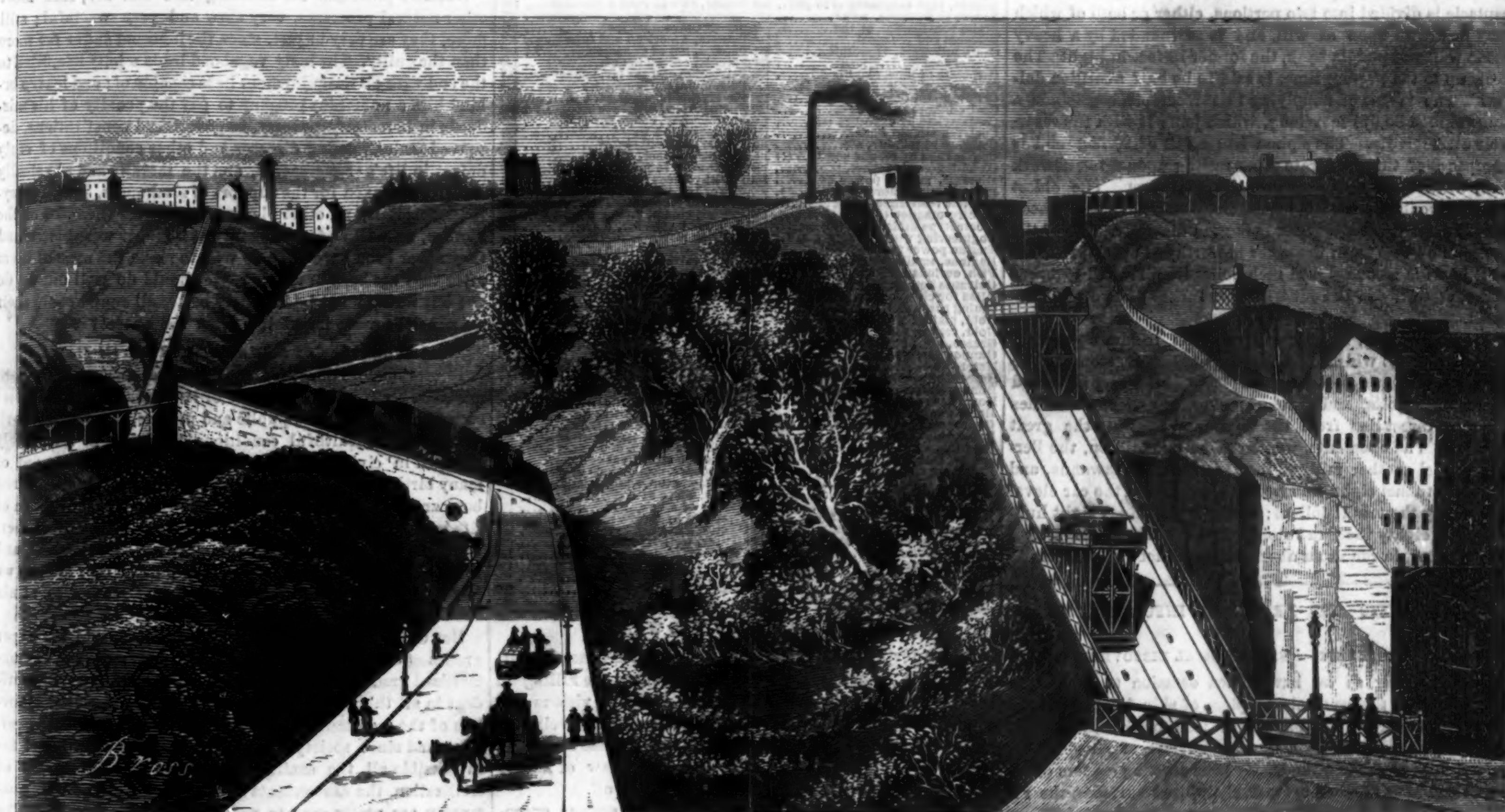
The means for getting through the ridge, consisting in open cuts, have necessarily been those adopted at the southern point, where the elevation as well as width of the hill is least. Furthest south of all is the cutting of the Newark and New York road, some 3,800 feet in length and 50 feet in depth. The hight of the ridge here is 80 feet. Operations were begun in 1867, and completed to a temporary grade of 100 feet to the mile, which, at the present time, is being cut down to 30 feet to the mile. The work necessitated skillful labor, since the excavations in progress are made directly beside the tracks over which the trains are constantly running.

The Pennsylvania Central cut is the oldest passage through the ridge. It is located three quarters of a mile to the north of the Jersey cut, and is a sinuous line in lieu of the direct path of the former. It is, consequently, some hundreds of feet longer. Operations are now in progress for straightening it. A new cut, at an angle to the old one, and near one extremity, was made about a year ago. Save in the magnitude of these works, there is little of especial interest; and owing to their being practically incomplete, no fair estimate of their future aggregate cost can be gathered. A rough calculation, however, based on the material removed, labor, etc., up to the present, gives about a million dollars as the probable outlay for both.

Nearly a mile to the northward, the ridge is entered by the Bergen or Long Dock tunnel. This great work was begun in 1856, and completed in 1860. It crosses the hill diagonally, and is 4,311 feet long, 23 feet high, and 30 feet wide. Eight large shafts, from seventy to ninety feet deep, were sunk from the summit down to its level. The traffic through this passage includes the immense business of the Delaware, Lackawanna, and Western and the Erie railroads. This of late has far exceeded the capacity of the tunnel, since it is not permitted for one train to enter until another preceding it in the same direction has emerged. A delay of at least five minutes is thus caused, and hence but twelve trains per hour on each track can be accommodated. As the tunnel belongs to the Erie, the Delaware, Lackawanna, and Western line is necessarily at a disadvantage, and hence the occasion for the beginning of a second tunnel by the last mentioned company, to which work we shall next allude. The Bergen tunnel, it may here be remarked, is estimated to have cost in the neighborhood of one million dollars.

The eastern or Jersey City approach and opening of the Delaware, Lackawanna, and Western tunnel, a sketch of which our artist contributes in the annexed illustration, is located about 2,700 feet to the north of that of the Bergen bore. The western ends of the approaches intersect, and this is caused by the Delaware, Lackawanna, and Western tunnel taking nearly a direct east and west course through the ridge, the angle between the two tunnels being forty degrees. The roads, however, do not cross, as the Erie track at the western end dips under that of the other line, lying some 19 feet beneath.

The Delaware, Lackawanna, and Western tunnel is now in progress. When completed, it will be 4,200 feet long, 27 feet wide, and 19½ feet high. It was begun in September, 1873, and work has been simultaneously prosecuted at the bottom of each of the six shafts and at the two approaches. About 1,200 feet are now finished, and it is expected that by the summer of 1876 the entire work will be complete. The character of the excavation presents no extraordinary feature. Trap rock is met everywhere, and the bore will be simply a clean cutting, reinforced with brick arches at the approaches and wherever signs of weakness in the rock may appear. Hand drilling is generally employed, and in the opinion of the contractors is more profitable than the employment of steam machinery for the purpose. The estimated cost of the tunnel is $800,000.



THE NEW RAILWAY TUNNEL AND STREET CAR ELEVATOR, JERSEY CITY, OPPOSITE NEW YORK.

The means for getting over the ridge are located at about a thousand feet still further north, and consist in the car elevator of the North Hudson County Car Company. This is also represented in the engraving, from which an excellent idea of its appearance may be obtained. Its object is to raise street cars, passengers, horses, and all, from the bottom to the top of the hill, a vertical hight of 102 feet 6 inches. The incline is about as one to four, and the entire length of the tracks 480 feet. Of these last there are two, firmly laid upon timbers at 7 feet 10 inches gage. The cars are drawn upon two trucks made of very strong framework, the upper platforms of which are level, while the lower portions are inclined, to fit the slope of the rails. When a truck is either at the bottom or top of the road, its platform is in such a position that the car can be directly driven thereon. The closing of a bar behind the vehicle then causes chocks to rise from the track, which rest against the wheels, holding the car in place and preventing the horses moving it until the bar is once more opened. Between the two trucks extends a heavy steel wire rope, which passes over suitable pulleys at the top of the incline. This acts as a kind of safety cord and, at the same time, causes the weight of one car to counterbalance that of the other, throwing less labor upon the hoisting machinery. The engineer is stationed in a kind of pilot house on the upper platform, beneath which is a

spacious room in which engines and boilers are located. The engines, two in number and of forty horse power each, are horizontal, and are connected directly to pinions which engage in large spur wheels arranged between the two winding drums. The latter are 12 feet in diameter, and to each are brought two 1¼ inch steel wire ropes, which serve to hoist and lower the tracks. Inside the engineer's house above are counterpoised levers connecting with the throttle and link, and a treadle operated by the foot, which governs friction and vacuum brakes on the drums. The average time of raising one car, while lowering another, is one minute, though the same can be done with safety in half that interval. The work was begun on July 1, and finished in November 21, 1874. Mr. John P. Endries is the designing engineer, and the Dickson Manufacturing Company, of Scranton, Pa., the builders. The total cost was $80,000. We understand that it is proposed to construct another and similar elevator further to the north, at a point where the ridge is 230 feet high.

The new distributing reservoir, now in process of construction under the supervision of Mr. J. P. Culver, Chief Engineer of the Jersey City Water Works, is located on the summit of the hill and between the positions of the elevator and the Delaware, Lackawanna, and Western tunnel. For many years past the Bergen reservoir, a small structure holding only a three or four days' supply for the city, has served the purpose of a distributor; but the increasing population has necessitated the present building, of larger accommodations. Work was commenced on the new reservoir in 1870, and will, it is expected, be completed so that a portion of the reservoir can be used during the coming fall. The area of the structure is 27 acres, or 700 feet wide by 1,700 feet long. Its capacity will be 23,000,000 gallons, this being a supply for 23 days. The depth of water will be 25 feet. The receptacle is divided into two portions, either or both of which may be drawn upon at will, and is surrounded by a heavy stone wall and puddle bank, the former 18 feet in hight. The cost, up to the present time, is said to be half a million dollars. The means of supplying this reservoir consists in a huge siphon 30,075 feet long, which joins it with the reservoir at Belleville. The siphon has a fall of 29 feet, and is composed of three separate pipes resting upon a trestlework bed, which is constructed over the meadows. The oldest pipe is twenty inches, and the others, which have been placed quite recently, are thirty-six inches, in diameter. One of the latter is of cast iron; the other is worthy of special remark, as it is made of one eighth inch boiler iron, riveted together and covered inside and out with two inches of hydraulic cement.

It is interesting, by way of conclusion, to sum up the aggregate amount which has been spent in overcoming the rocky obstacle which Nature has placed at the very threshold of the metropolis, and through, over, or under which lies the most direct line from the West and South to the great market. The open cuts we placed at one million, the Bergen tunnel another million, the Delaware, Lackawanna, and Western tunnel eight hundred thousand, and the car elevator eighty thousand dollars; total, two millions eight hundred and eighty thousand dollars, or, including the second car elevator, in round numbers three millions of dollars.

SCIENTIFIC AND PRACTICAL INFORMATION.

HETEROPLASTY, A NEW MEDICAL DISCOVERY.

Skin grafting, as we have taken occasion to explain in some detail, is the removal of a piece of skin from the sound part of the body of the patient, or from another individual, and placing the same upon the raw surface of an obstinate ulcer, burn, or other wound. By thus creating centers of eccentric cicatrization on extensively injured surfaces, the rapidity of the healing process can be much accelerated.

Dr. R. J. Levis, in an extended article on this topic which we transferred to our columns some months ago, alluded to the possibility of obtaining the necessary grafts from limbs amputated for traumatic injuries. This has been repeatedly tried by Dr. Anger, of Paris, and with such remarkable success that the result is considered as certain as if grafts directly obtained from the patient were employed. Dr. Anger, however, proceeds further, and has used, not merely epidermic grafts, but those comprising much thicker layers—dermo-epidermic, he terms them—and finally he is enabled to employ the entire thickness of the skin, and even the subcutaneous cellular tissue. He has successfully transplanted grafts of the last description from 0·3 to 0·6 inch in diameter, obtained from the palmar face of an amputated finger. These were applied to an open ulcer on the leg of the patient and bound in place by diachylon bandages. Three days after the grafts were intimately united with the injured surface and manifestly vascularized. Heteroplasty is the new name given to the operation.

THE CHEMICAL CONSTITUTION OF THE BRAIN.

M. Gobley has recently completed extended investigations on the above subject, from which we adduce the following results: The human cerebral substance contains about 80 per cent of water. Two albuminoid matters are present, one not differing from albumen and soluble in water; the other is insoluble, and for this the investigator proposes the name of "cephaline." The fatty substance of the brain is formed principally of cholesterin, lecithin, and cerebrin, and also olein and margarin. The organ contains certain salts, some soluble in water and in alcohol, others soluble in water and not in alcohol. During decomposition, the cerebral pulp furnishes acid products, among which are oleic, margaric, phospho-glyceric and phosphoric acids.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year, postage included........................$3 20

One copy, six months, postage included........................1 60

Club Rates:

Ten copies, one year, each $2 70, postage included........................$27 00

Over ten copies, same rate each, postage included........................2 70

☞ By the new law, postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written, and also state at which time they wish their subscriptions to commence, otherwise they will be entered from January 1st, 187.. In case of changing residence state former address, as well as give the new one. No changes can be made unless the former address is given.

VOLUME XXXII., No 9. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, FEBRUARY 27, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

THE GENERATION OF THE WICKED.

It is a fortunate circumstance that vice is ultimately self-destructive. Lust, violence, and debauchery are killing in themselves; and the children of the brutally vicious are very apt to enter upon the struggle for existence weighted with such an inheritance of weakness and disease that their early extinction is all but inevitable. It is a law of nature that the generation of the wicked shall be cut off.

To this beneficent law, however, there are serious exceptions. Certain phases of criminality—as may be seen any morning in our police courts—are not only consistent with but are usually accompanied by abundant animal vigor, capable of indefinite propagation; and the probabilites are that the criminals of future years will be chiefly descended from the sturdy sinners for whose restraint the police systems of to-day are mainly required. The criminal class, like the pauper class, is to a great extent an hereditary caste, representing the uncivilized and largely uncivilizable elements of the community. How to deal with this class, how to turn its perverted forces into useful channels, and make its perpetuation difficult if not impossible, is the great social problem of the day.

Victor Hugo has said that the quickest way to civilize a man is to civilize his grandmother. The saying is worthy of a place among the axioms of social science. Certainly when society neglects the grandmother—as it did in the case of the waif called "Maggie" (referred to in our paper of January 9), to whom Dr. Harris traces such a pestilent brood of human vipers—the succeeding generations are pretty sure to pay a heavy penalty in perpetuated savagery. Probably each one of the small army of criminals, lunatics, drunkards, imbeciles, and the rest, to which she gave being, has cost the country more than would have sufficed for the reclamation of a dozen such grandmothers to be, certainly enough to surround them with conditions which would make it impossible for any one of them to stock a country with criminals and paupers.

It will not take many such cases, it is to be hoped, to rouse the community to an appreciation of the urgent need of greater watchfulness in regard to the development of vagrant children, and all children not subject to wholesome influences. Who can say how many Maggies are skulking about city and country to-day, or cowering in homes of brutality and vice, receiving the training requisite for making them criminals and breeders of criminals? For its own safety, let alone the children's present and future welfare, society is bound to adopt more liberal and thorough measures for removing such heirs of crime and criminal poverty from their corrupting environment, and for training them in ways of industry and morality.

It may be impossible to make much of such unpromising material, nevertheless it is possible to prevent much; and with social as well as with individual disease, prevention is better than cure. Every boy or girl growing up in beggary and lawlessness is the possible ancestor of a line of pariahs, as numerous and burdensome as Maggie's have been; and neither prudence nor philanthropy can tolerate the neglect of them. As a matter of justice, too, society has as little right to allow the future to be afflicted with the pernicious fruit of such pernicious stems as it has to stock the fields with poisonous plants, or knowingly to establish the conditions for the development of future pestilences.

How Can Society Help Itself?

Primarily, by civilizing, so far as possible, the naturally uncivilized grandmothers, not forgetting the grandfathers also, by bringing them up in habits of honest industry in useful occupations: not in unnatural masses in prison-like asylums, but in workshops and families. This done rigorously, the criminal class will be largely cut off by conversion into something better. We shall have cause for thankfulness when so much is done. But the time is probably coming when society will see the necessity of taking still more radical measures for the prevention, not only of possible crime, but of possible criminals. In a more immediate and active sense than the words now carry, the generation of the wicked will be cut off.

Nature's processes for effecting this end are, like most other natural processes, very slow and very wasteful; still more, they are very unjust, since the innocent suffer far more than the guilty. The lusty vagabond leads a jolly life, filled to the end with all the enjoyment he is capable of; and leaves behind him a numerous progeny to pay the penalty of his misdeeds in hereditary poverty, impoverished constitutions, depraved tastes, wasting diseases, and other conditions of early defeat in life's engagements, and the morally and physically healthy are taxed for the support of almhouses, prisons, asylums, hospitals, and other places of refuge for them. For the victims, as well as for humanity at large, it were better had they never been born. We do well to make the most of them after they are born—or rather, we should do well did we do so; but would it not be infinitely better all round could their existence be made impossible from the outset?

Advantages of a Diminished Birth Rate.

The rational tendency of high civilization is toward a diminished birth rate. The waste of life that goes on in ruder societies, through wars public and private, through improvidence and unhealthful conditions of living, is immensely lessened in civilized communities, and with it the need of many births. A vastly larger proportion of the children born are able to attain maturity, and the average duration of life is much increased. A low birth rate is therefore perfectly consistent with high national power and progress, and the development of all that makes life desirable; and, as we have said, the tendency of civilization is always to attain such an economical birth rate.

But unfortunately, while the law holds good in the upper grades of civilized society, the lower and more or less uncivilized grades are under no such moral restraint. Improvident in all things, they are equally so in human life. Careless of the responsibilities of parentage, they breed like vermin; and since society throws around their offspring so far as possible all the sanitary conditions and advantages of civilization, the descendants of the lower half of any community are pretty sure to preponderate numerically. The criminal grades are especially prolific, more than enough so to make up for the destructive influences of crime. The effect upon the future well being of society can scarcely be other than disastrous, unless special effort is made to counteract the evil by preventive as well as by curative means.

The Knife Remedy.

We can only regard it as an illustration of the power of popular prejudice that people, who find nothing to condemn in the extermination of individuals whose murderous nature seems incompatible with public safety, are ready to hold up their hands in horror at the most guarded suggestion of the advisability of making it impossible for lusty savages to inflict upon the community a brood of ill balanced organisms, destined to swell the ranks of vice and crime. Yet society may be driven to adopt just such radical measures in self-defense, driven to make sterility one of the penalties for the grosser forms of criminality.

The effect on the criminal statistics of this city for the next hundred years would be something marvelous, we fancy, were the worst offenders against public peace and morality sent to the island—not as now to recuperate their wasted forces and return in a few weeks to enter more lustily than ever upon their evil courses—but to be made perfectly harmless as regards the future. In this way only, can the stream of tendency which makes for unrighteousness be dried up at its source.

It has been objected that the subjects would be spoiled as human workers, through loss of ambition and energy; but the objection scarcely holds in view of the fact that their representatives in the East have from the earliest times been prized for their serviceableness. Besides, they are of little worth as workers as they are, and the change would rather tend to diminish their rampant beastliness and make them more amenable to civilization. Many an unmanageable

human brute might thus be converted into a quiet toiler, as useful and harmless as the placid creature whose patience under the yoke of labor is proverbial. At any rate, his higher potency for evil would be eliminated. The operation is not an uncommon one for the saving of individual health: How much more justifiable, then, for the protection of the moral health of the community—for the prevention of that worst of social distempers, hereditary crime?

HOW TO RUSH A PATENT THROUGH.

It appears that the best way to get a new patent rushed through and quickly issued is to apply at the presidential mansion. In a recent case—a telegraph contrivance—the President wrote a letter to the Commissioner of Patents, requesting him to take immediate action, for the reason that the invention was needed for use by the government, and had already been adopted on the government lines. Whereupon the Commissioner issued a patent, "quicker," to use a homely expression, "than you could say Jack." But we think it will strike most of our readers, as it does ourselves, that the reasons assigned might have been more properly used for postponing instead of hastening the grant of the patent. In the case of a poor inventor, whose application has been long pending, the Patent Office should be as prompt as possible. But with respect to inventions for which the government patronage has already been secured, as in the present case, what possible difference can it make to the government whether the patent is granted today or next month?

All unnecessary interference with the usual order of business at the Patent Office, whether by the President or any other public functionary, is pretty sure to create dissatisfaction, and should be scrupulously avoided. Instead of writing requests to favor the interests of his personal friends, it would be much better if President Grant would indite communications something like the following:

To the Commissioner of Patents:

I am informed that many applications for patents are lying in your Office unexamined, and that, in the class which embraces telegraph apparatus, there are cases filed more than a year ago, which still remain undisposed of. This is a crying shame and ought no longer to be tolerated. No class of individuals has done so much for the benefit of the country as our inventors; and when they apply for patents, every possible endeavor ought to be made by the Patent Office to give them a prompt and favorable hearing.

With the large corps of assistants under your command, numbering, as I understand, about five hundred persons, including one hundred examiners, is it not possible for you to bring up the business now in arrears, and in future have things attended to with more promptitude?

I see by your report for last year that you *rejected between five and six thousand applications for patents.* It must have required an immense amount of time and labor on the part of your people to hunt up reasons for this enormous mass of adverse decisions.

Do you fully realize that the majority of these five thousand rejected applicants are poor people, and that your rejections, especially if wrong, carry injury and disappointment into that number of families?

For my part, were I Commissioner of Patents, I would not hesitate to grant a hundred doubtful patents rather than take the risk of depriving one of my inventive countrymen of the full benefits which the law intended to give him.

I beg to remind you that the object of the Patent Office, as intimated in the Constitution, is to encourage the progress of the useful arts by *the grant of patents to inventors.* But if I were to juoge, from your great number of rejected cases, I should say that the Patent Office appeared to consider its prime duty to be, *to refuse to grant patents.*

I have confidence in your ability to remedy the unsatisfactory state of things I have mentioned, and I shall look to you for immediate and effective action. Let us have peace.

U. S. GRANT.

SPONTANEOUS COMBUSTION AT STEAM HEAT.

A correspondent (W. A. S.) sends a piece of charred wood taken from a plank which formed a portion of a box inclosing a steam pipe conveying steam at a pressure of about 80 lbs. per square inch. The wood is as completely charred as if it had been prepared by the ordinary process of burning. It is black, friable, and thoroughly deprived of all its volatile constituents.

This is a simple illustration of what occurs very frequently at temperatures exceeding 300° Fah. The moisture and volatile matters contained in woody fiber are driven off and carbon only is left, at temperatures exceeding 300°, the rapidity of the change increasing as temperatures rise. The precise lower limit of temperature of charring is not known; but when that above given is approached, the change occurs very slowly. As stated in a previous issue of the SCIENTIFIC AMERICAN, a piece of wood has been left in contact with a steam pipe conveying steam, during the cold season, at 50 lbs. pressure, for sixteen years, without exhibiting evidence of serious injury. The temperature there was about 295° Fah. Violette charred wood at 302° Fah., and the temperature of the steam which produced the carbonization referred to by our correspondent was about 325° Fah.

In order that combustion shall occur, it is evidently necessary, not only that the temperature shall be sufficiently high to increase the tendency to ignition, but that it must actually attain the temperature of ignition; and to produce spontaneous combustion in such cases, the temperatures of carbonization and ignition must coincide. In our issue of January 2, we showed, by the graphic representation of the law of decrease of temperature of ignition, with that of carbonization, that it was approximately expressed by a parabola and that, unless some sudden change of law occurs at ower temperatures than those recorded, this coincidence cannot take place, and that, consequently, wet steam at ordinary pressures cannot ignite—although it may char—woods

Our correspondent speaks of this piece as "almost burnt to charcoal." The expression and the idea represented by it are incorrect. Charring and burning are two quite distinct processes. The one is the expulsion of gaseous constituents from organic matter; the other is the rapid union of any combustible material with oxygen. It does not, by any means, follow from the fact that the wood is charred that there has been any oxidation or true "burning." Wood becomes charred in the process of burning, usually, merely because the oxygen seizes upon the volatile constituents first, and only takes the carbon when it may not choose between equally available molecules of the two classes of combustible substances. The slow process of carbonization illustrated by the example given by our correspondent, the more rapid process of charring in the usual methods of manufacture of charcoal, and the charring noticed when wood burns in the fire, are all identical, except as to time and completeness. Ignition and combustion are entirely independent processes, and we have no evidence which seems reliable that the gases can take fire at temperatures lower than about 800° Fah., or that charcoal can ignite at least han 600° Fah. We do not think it impossible, or even improbable, that, under peculiar and rarely occurring circumstances, the condensation of inflammable gases within the pores of charcoal, which is a wonderful absorbent, or its saturation with readily oxidating materials, like the oils, may, by oxidation, be gradually accelerated in rapidity of action, and produce sponr taneous ignition and combustion. We have, however, no knowledge of well authenticated instances even of this. Ou correspondent will probably find it necessary to actually apply flame to his charcoal board to set it on fire. He will also notice that wood "smokes" before taking fire—an indication that the temperature of carbonization is probably lower than that of ignition.

AN IMPORTANT PATENT OFFICE DECISION.

We published last week a recent decision by the Commissioner of Patents, in which he announced the adoption of a new rule and practice at the Patent Office in respect to old rejected cases. The decision was to the effect that rejected cases of more than two years' standing are not in future, except under certain circumstances, to prevent the grant of new applications for patents. This decision substantially recognizes and adopts the view expressed in the previously rendered decision of the Board of Examiners-in-Chief in the case of Greenleaf and Adams.

The latter decision, in addition to the above dictum, contains another important announcement, to the effect that the Board of Examiners-in-Chief is a tribunal having independent judicial powers. Its decisions are, therefore, binding upon the Commissioner and all persons and actions of the Patent Office, until set aside by a higher tribunal.

This is a very interesting and important adjudication, because, when properly recognized, its tendency is to render the decisions and practice of the Patent Office more uniform and reliable than heretofore. The notion has heretofore prevailed that the Commissioner was the absolute ruler of the Patent Office, and that he might, if he saw fit, set aside any decisions of the Examiners, or of the Board of Examiners-in-Chief. But it now appears that he cannot lawfully do so.

The decision is very ably written, and is so interesting and important that we commence the publication of the text in full on another page

CHILDREN AND DOGS.

"Dogs is healthy for children" say the old wives, and not without some foundation in fact. The influence of these lively and affectionate playmates of childhood is very happy: so much so that we have sometimes thought that a boy who has never had a pet dog has been cheated out of half the enjoyment and no small part of the moral culture of infancy. But dogs have bad tricks, and, unless properly trained, are apt to be anything but "healthy" for children. They express their affection in a very bad way. We know that it is a common opinion that there is something wonderfully wholesome about a dog's tongue, and that his natural habit of licking the objects of his affection is rather to be encour aged than repressed. Nevertheless one of the first require ments in a dog for a child's pet is that he be trained to emulate prudent humanity and restrain his tongue. It is not "healthy," whatever the old wives may say. This, setting aside the question of rabies altogether. A much more common affection of dogs is a tape worm, for whose development both men and dogs have to contribute. Its immature or cysticercal stage is spent in the human body, often causing great mischief; then it migrates to the dog, completes its development, and makes provision for a new crop to infest humanity, forming cysts or hollow tumors in various parts of the body. The full grown worm is the smallest tænia known, only about $\frac{1}{4}$ of an inch in length. The embryo is often as small as $\frac{1}{800}$ of an inch; yet, according to Cobbold, death has been caused by a single individual lodged in the brain. At a late meeting of the Australian Microscopical Society, Mr. Sidney Gibbons exhibited specimens recently taken from a human subject, and said there could be no doubt that they were frequently implanted in children as a consequence of allowing dogs to lick their hands and faces. It is a nasty practice at best, and a pet dog's first lesson should be to keep his tongue to himself.

LABOR TROUBLES IN RUSSIA.

The first fruits of emancipation in Russia and in our Southern States have been much the same. Like the freedman, the serf released from practical slavery thinks that freedom means the right to do nothing and go where a vagrant inclination may lead him. Serfdom meant involuntary servitude and confinement to his native district, and naturally his undisciplined sense of liberty impels him to do the opposite. So he wanders about, and works only to keep from starving. Under the old system, a pauper peasant was an impossibility; under the new, the lowest poverty is the rule. The effect on the industrial interests of the country is little short of ruinous. Labor cannot be obtained, even where wages are relatively high, as in the fertile provinces of the South and Southeast, without prepayment, sometimes to the extent of eight months' wages, and that without any security that the work will be done. That a contract is in any way binding is quite beyond their moral comprehension. If paid in winter to secure their services in the spring, they are quite as likely as not to be missing when the stipulated time arrives; while those who do report for service are in the habit of deserting at the most critical moments without warning and without cause. Factories are abandoned in the stress of business, though the men have signed regular contracts; and farms are left untilled, unsown, or unreaped, simply because laborers already paid prefer to work for a neighboring proprietor. The money paid in advance cannot be recovered, nor the deserters punished for their treachery. Not that there is no law to reach the case; the trouble is the justices, whose duty it is to regulate such matters and decide in labor disputes, invariably favor the workmen. "The mass is a powerful fellow," they say, and decline to take any steps to bring themselves into disfavor with the "powerful fellow" who votes them into office. The agricultural development of the country is especially hampered by this lack of trustworthy workmen, and large tracts formerly under cultivation are being turned into grazing land; while the peasantry gain only in poverty and improvidence, living from hand to mouth, and spending the most they earn in vagabondage and brandy. The matter has lately been taken in hand by the Government, and a new commission appointed for the codifying of the laws of contract and other labor regulations. It is hardly to be expected, however, that any speedy amelioration of the trouble will be effected.

HORSE FLESH AS FOOD IN FRANCE.

Though among the last of the people of northern Europe to authorize the sale of horse flesh as food, the French have learned to use it to a greater extent, apparently, than any other nation. It is used in as many ways as beef; and according to a late writer, M. Husson, in the *Economiste Français*, the trade in it is actually more profitable than the ordinary butcher's business.

On the first day of 1874, there were in Paris forty-eight shops for the sale of the flesh of horses, mules, and asses, their customers belonging chiefly to the middle classes—clerks and thrifty workpeople with families. As a rule, the price of the meat is about half that of beef, the best cuts ranging from a franc to a franc and a quarter for the half kilogramme, or from twenty to twenty-five cents a pound. It is in the form of sausage, however, that the largest quantity of this meat is consumed. The tongue, brain, and liver are sold as delicacies, and the fat is converted into "butter."

In consequence of the increasing taste for horse flesh, the price of worn-out horses has increased enormously of late, those fit for food fetching from twenty-five to thirty dollars: a few years ago they could be had for five or ten dollars.

From unpublished official documents, M. Husson finds that the number of horses, asses, and mules, consumed in Paris during the seven years and a half preceding 1874, was 73,655, more than half of which, however, were eaten during the two sieges. Since the war, the number eaten annually has been from nine to ten thousand. In Munich, Berlin, Vienna, and other German cities, the growing taste for horse flesh is almost equally marked.

Curiosities of Welding.

There has lately been shown in this country a very interesting specimen of blacksmith work. By means of Schierloh's welding compound, it is alleged that, in one example of a bar of Bessemer steel, five different kinds of iron and steel have been perfectly welded, without changing its shape in the least. The bar was rolled into form at Thompson's steel works, in Jersey City, and is $\frac{1}{2}$ by $2\frac{1}{4}$ inches in the cross section.

First, a piece of Bessemer steel, cut from the end of the bar, was welded fast to it again, the heating and welding occupying eight minutes. On the reverse side of the bar a piece of fine cast steel was welded in six minutes. Further along on the bar a piece of blister steel was welded in eight minutes. This same steel cannot be welded with borax, as the high temperature needed with that flux makes it as brittle as cast iron under the hammer. Opposite this a piece of wrought iron was welded in six minutes, and further along on the bar a piece of cast iron was welded in three minutes. This was a piece of the mold board of a plow. The bar, with its additions, was then ground and polished on the edge, so as to show the points at which the welded metals came into contact. No weld was visible on any one of them, and the difference in the metal could only be told by the color after polishing. This solves a great many important problems in iron manufacture, among others the welding of Bessemer scrap

Annual Report of the Commissioner of Patents.

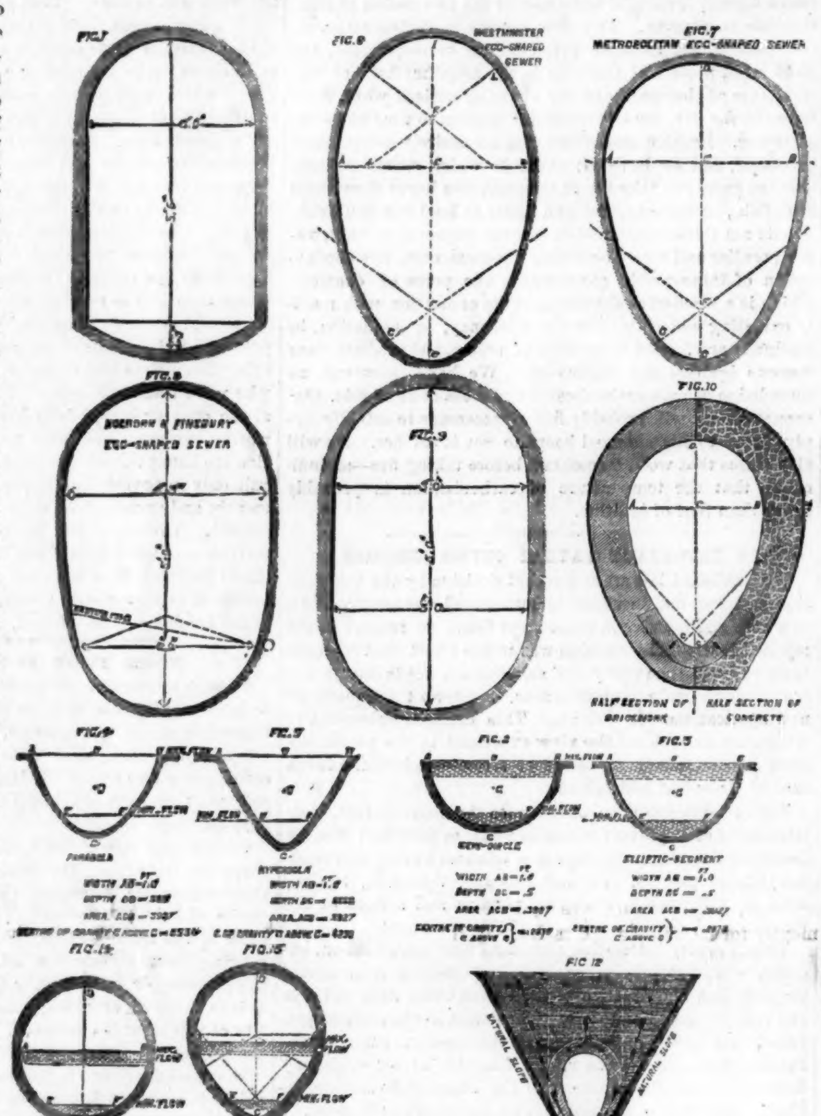
The annual report of the Commissioner of Patents to Congress has been sent in, and shows that 21,602 applications for patents were made during the year 1874, and 13,599 patents were issued, leaving 8,003 applications, or 37 per cent of the whole, that were either rejected, delayed, incompleted, or for some other reason not patented. We shall give a more full abstract of the report in our next

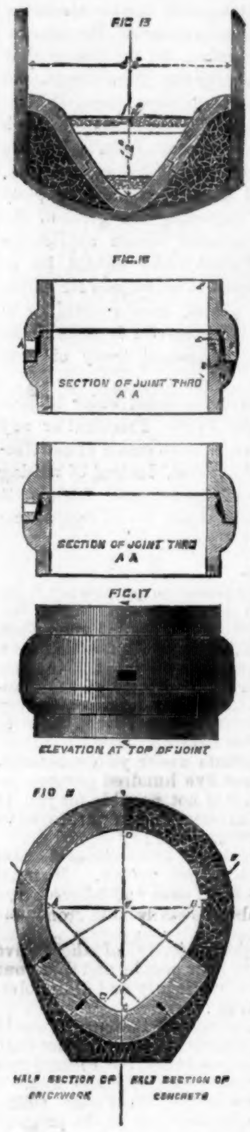
THE PROPORTIONS OF SEWERS.

At a recent meeting of the Society of Engineers, London, Mr. John Phillips read an interesting paper on the forms and construction of channels for the conveyance of sewage, in which he said:

"The water carriage system consists of a series of drains and sewers laid to various inclinations for the purpose of receiving and carrying away the water we use and the filth we produce in our houses and towns. The efficiency of this system depends, as its name implies, upon the gravitating power of the water to remove not only itself, but the organic and inorganic matters which it receives. And as the water derives the requisite power to do this from the form, the fall, the size, and the construction of the channels in which it runs, it is imperative that by no defect in either of these respects should any of this power be wasted or lost; for the more power the water has the better it raises and holds the matters in suspension and propels them forward, the quicker it carries them with it to the outfalls, the cleaner it keeps the drains and sewers, the freer these are from noxious gases, and the purer is the atmosphere and the healthier are the inhabitants of houses and towns. At different periods various forms have been used for drains and sewers, such as the square, the rectangle, the triangle, the circle, the semicircle, the oval, the semi-oval, and parts of these combined. But the best form is that of an egg, broad at the large end and narrow at the small end, and this end placed downwards. For by this form the channel imparts to the same quantity of sewage greater velocity and scouring power, the sides and crown offer greater resistance to the pressure of the ground, and the amount of excavation required for its execution is less than any other form. The egg shape and the circle are now employed for large sewers constructed of bricks, and the circle for stoneware pipe sewers and drains."

In the course of the paper, Mr. Phillips described the various sections of sewers in common use, of which we give illustrations, the following being the particulars of each:





CROSS SECTIONS OF LONDON SEWERS.

Fig. 1 is a section of two large sized sewers, constructed in Westminster 80 years ago. Little care was bestowed on the masonry of sewers in those days, bricks, mortar, and labor being economized to the utmost extent; and the width and flatness of the bottom of the sewer diffused the flow and destroyed its "scour," from which the carrying power is derived. This led to accumulations of detritus in the sewer, and consequent failure of the gully or branch sewers; and it became necessary to ascertain which form of sewer would best give the required velocity to the liquid, and carry the whole of it to the outfalls. Mr. Phillips, therefore, made experimental channels along the sewers, as shown in A C B, Figs. 2, 3, 4, and 5—Fig. 2 being a semicircle, Fig. 3 an elliptical segment, Fig. 4 a parabola, and Fig. 5 a hyperbola; and he computed the areas, perimeters, and velocities of flow of all of them, the experiments extending over several months. Fig. 5 gave the least tendency to deposit; next in degree came Fig. 4, Fig. 3, and Fig. 2, in the order named. This result was caused by the contraction of the bottom of the channels, deepening the flow, and so giving the stream greater gravitating energy.

As a result of these and other considerations, the author designed an egg-shaped sewer, shown in Fig. 6, to take the place of that in Fig. 1. Twenty miles of this sewer were laid down in 1846 and 1847; it proved to be completely self-cleansing, and a saving of $7,500 per mile over the cost of the Fig. 1 sewer was effected, the total showing an economy of $150,000. Its proportions are: $CI=1\frac{5}{8}$ AB, $CE=AB$, $CF=\frac{1}{4}$ AB, $GH=1\frac{1}{2}$ AB, $AJ=\frac{1}{6}$ AB, $EK=\frac{1}{4}$ AB, $JL=\frac{5}{6}$ AB, $KL=\frac{5}{12}$ AB. The one shown in Fig. 7 is considered to be a still further improvement, and is now generally adopted in Great Britain; its proportions are: $CD=1\frac{1}{2}$ AB, $CE=AB$, $CF=\frac{1}{4}$ AB, $GH=1\frac{1}{2}$ AB.

Fig. 8 shows a modified form of Fig. 1, and is superior to it for cleansing, strength, and economy; but in all these points it is surpassed by Figs. 6 and 7. It was designed to replace Fig. 9, the defects of which are apparent in consideration of the abovementioned experiments. Fig. 10 was proposed by Mr. Phillips as an improvement on Fig. 7, which latter, however, may still be used where the flow is large; but elsewhere, Fig. 10 must be considered to show many advantages. Fig. 11 is a modification of Fig. 10, of which the proportions are ascertained as follows: Divide AB into 11 equal parts; then $EC=7\frac{1}{2}$, $CD=13$, $FC=2$, and $GH=21\frac{3}{4}$ such parts.

Fig. 12 shows the manner in which the weight of superincumbent earth bears on a sewer, and demonstrates the necessity of great strength in the crown of the work. Fig. 13 shows a method of improving flat-bottomed sewers by narrowing the channels. Figs. 14 and 15 are old and new forms of auxiliary or branch sewers, the latter having all the advantages aimed at by Mr. Phillips in designing the sewers shown in Figs. 7, 10, etc. Figs. 16 and 17 show methods of making joints in pipe sewers. "Where, from inadequate inclination or body of sewage," says Mr. Phillips, "the velocity of the flow is insufficient to carry away the silt, sand, and other solid substances which are washed into sewers from sculleries, areas, yards, streets, and other places, these materials become embedded and entangled with the excreta, fat, hair, paper, and other matters, and form hard compact masses along the bottom. Wide, flat, and extremely rough surfaces are thus produced, which diffuse the flow, weaken its force, and no flush of water is strong enough to tear it up and remove the accumulation. Hence it is of the first importance to keep detrital substances out of the sewers as much as possible. This may be done by forming catch pits under the sinks and gulleys, and emptying them directly after every rainfall. Where no such appliances are provided or the emptying of them is neglected, detritus gets into the sewers, causing putrifying matters to deposit, and foul gases to generate and escape into the houses and streets where the drains are improperly trapped and are unventilated."

Bohemian Glass Bad for Chemical Analysis.

M. P. Truchot states that glass vessels in which various liquids, and even pure water, are boiled give up by degrees a small quantity of their substance, silica, potash, soda, and lime. The analysis is the more erroneous the longer the boiling is kept up. This, at least, is what results from the use of glasses brought from Germany, and sold at Nancy in 1873 and 1874. This fact may be shown by boiling in a flask pure water mixed with a tincture of red cabbage or sirup of violets, slightly reddened by an acid. After boiling for a few minutes, the liquid turns green. French glasses, with a base of soda, are not sensibly attacked, and therefore do not offer this inconvenience.

A PHYSIOLOGICAL THERMOMETER.—Dr. Edward Seguin proposes a centigrade thermometer in which the zero point shall be marked at +37°, equal to +98° Fah., the nominal temperature of the body. Deviation of the mercury from this point would be understood at once as indicating irregularity in the system, by persons who might not be aware of the temperature as above mentioned.

A Brilliant Light.

Professor John Spiller communicates to the London Photographic Society the following method for a temporary light of great power, useful for photo and other purposes:

"When common saltpeter (nitrate of potassium) is heated to a temperature somewhat beyond the point of fusion, in a hard glass tube or porcelain capsule mounted over a spirit lamp, and small pieces of sulphur are then successively introduced, a deflagration ensues, accompanied by the emission of an exceedingly brilliant white light, which is maintained as long as any of the sulphur remains floating as a molten globule in the fluid nitrate.

"The cost of this light is very trifling, both ingredients being remarkably cheap. One ounce of niter melted, and fed with sulphur at the rate of eight or ten grains at a time, will keep up a brilliant light for about ten minutes, at the cost for materials of one cent; but it must be confessed that the wear and tear of apparatus, from the intensity of the heat, adds to the cost of production.

"To guard against fracture or actual perforation of the glass during the course of the experiment, it is necessary to provide a tin tray into which the fluid contents of the flask may drop in case of accident. An ordinary spirit lamp is found to give sufficient heat to melt the niter and start the reaction; when once the light is produced, the spirit lamp may be removed, or the holder supporting the flask turned aside. Short lengths of stout 'combustion tubing,' closed at one end, serve exceedingly well for making the experiment, this kind of glass being so difficultly fusible. If iron capsules be employed, it is only possible to work with the top light, which may, however, be reflected to any required angle; and with porcelain crucibles much of the effect is lost by the partial opacity of the material. In the event of the niter-sulphur light being required to be maintained for a lengthened period, it would, of course, be desirable to provide some kind of chimney to carry off the gaseous products of combustion, or absorb the sulphurous acid with peroxide of manganese.

"With respect to the actinic value of the light, I find that from three to five seconds' exposure, according to the density of the negative, is sufficient to give a collodion transparency at a distance of a foot from the source of light, when produced on a small scale. The maintenance of a constant degree of intensity is, perhaps, one of the points open to future improvement.

"I have tried the use of nitrate of sodium in place of the ordinary saltpeter, and experimented with various metallic sulphides and finely divided metals; but none of these answered so well as the simple attack of sulphur, in the form of roll brimstone, by melted niter. Their spectra also appeared to be more limited. With the chlorate of potassium and sulphur a light of dazzling brilliancy is emitted; but the deflagration is very violent, and white fumes are given off by reason of the greater volatility of the chloride of potassium—a by-product in this reaction.

"In conclusion: I have only to state that no claim of novelty is set up for anything beyond the photographic use of the nitro-sulphur light, the light itself having been shown as a lecture experiment certainly as far back as the year 1847."

A Great Ice Slide.

A correspondent of the SCIENTIFIC AMERICAN, who resides in Norway, states that, in the eastern part of that country, large quantities of ice are gathered and stored in the ordinary manner during winter, for shipment abroad. Last summer a company tried to make the vast glaciers near Bergen supply the ice; to that effect a shoot made of spars was built, starting at an altitude of 2,200 feet, running down to the fjord, the whole length being 8,000 feet; the incline varies from 1 in 3 to 1 in 4 feet. At the lower end, the shoot runs level for a short distance and terminates in a shed, at which the vessels are loaded. The blocks of ice make the run in 4 minutes, although the speed is checked at several places. The average velocity of the ice blocks is 24 miles an hour. The ice is of a fine quality, and the supply is, of course, next to inexhaustible.

By rubbing metallic surfaces with soda amalgam, and pouring on a solution of chloride of gold, gold is taken up by the amalgam; and it is only necessary to drive off the mercury by heat, to obtain a gilded surface that will bear polishing

NEW CHILIAN ARMOR CLADS.

The Chilian Government two years ago requested Mr. Reed, M. P., of England, to prepare a design for an armorclad vessel whose tunnage should not be more than about 2,000 tuns builders' measurement; to have 9 inch armor at the water line; to have several 12½ tun guns with great command of fire on bow, broadside, and stern; and to have a measured mile speed of from 12½ to 13 knots, with twin screws. To fulfil all these conditions, which were quite unprecedented in a rigged, seagoing ironclad, Mr. Reed prepared a design of a vessel of which the following are the leading features: The length between the perpendiculars is 210 feet, the extreme breadth is 45 feet 9 inches, the depth in hold is 21 feet 8 inches, the tunnage being about 2,032$\frac{8}{94}$ tuns (builders' measurement). The draft of water forward is 18 feet 8 inches, aft, 19 feet 8 inches, and the mean draft, 19 feet 2 inches. The hight of the port sill from the load water line is 7 feet 6 inches. The armor is 9 inches thick at the water line, protecting the engines and boilers, 8 inches thick in wake of the gun slides, and of varying thicknesses elsewhere on the sides and on the athwartship battery bulkheads. The usual amount of taper is given to the thickness of the armor on the belt forward and aft. Behind the armor the teak backing is from 8 to 11 inches in thickness; with the ordinary arrangement of longitudinal girders worked on the two thicknesses of plates behind armor, the latter being supported by 10 inch frames placed vertically on the inside of the plates behind armor.

The armament consists of six 12½ tun guns, manufactured by Sir W. Armstrong and Co. These guns are placed in a central armor-plated battery, arranged as shown in our engraving. The peculiar recessing of the sides of this battery makes it possible for the two fore guns to command a range of 93°, namely, from right ahead to 3° abaft the beam—the two after guns to command a similar range of 93° from right aft to 3° before the beam—while the two middle guns command a range of 85°, extending between 20° from a right-ahead fire to 15° abaft the beam. It can also be easily seen from the sketch referred to that the three guns on either side can be readily combined in a broadside fire, while the four foremost guns can be worked so as to form a powerful combination for firing ahead. Altogether, then, every point in the horizon is commanded by these six guns in a small and compact battery.

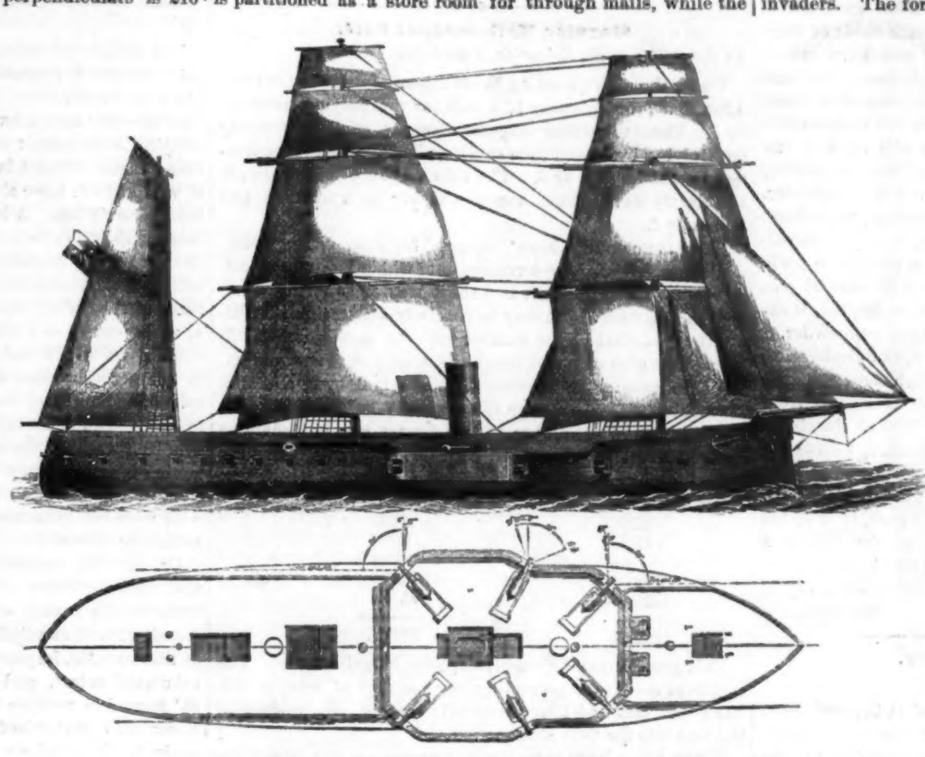
The speed of the Almirante Cochrane, the first of two vessels recently completed, at the steam trial, was very nearly 13 knots, and this was easily sustained continuously when a strong breeze was blowing and the sea rough. Under favorable circumstances it is fully expected that the speed would be a little over 13 knots. The engines of the most modern compound type, of 500 nominal horse power, with horizontal cylinders, are manufactured by Messrs. J. Penn & Son, for both ironclads. The weight of the coal carried in the bunkers is 240 tuns, and provision for additional coal is made.

These vessels are also supplied with a good spread of canvas, which is distributed, as shown in the engraving. This will allow them to be independent, to a certain extent, of their coals and machinery in going long distances, and they will have all the advantages that nautical men claim for sails to keep vessels out of the trough of the sea in case both engines get disabled. The chances of such an event happening are, however, remote. The chief object in providing the sails in these vessels is no doubt the saving that they effect in the coals; and as the rigging in no way interferes with the range of fire, as it inevitably must in a vessel with turrets, there were several reasons in favor of their adoption.

The hull of the vessel is built of iron upon the bracket frame and longitudinal system, and an inner bottom is fitted throughout the whole length of the engine and boiler room, as in the most recent ironclads of the British navy. The main deck outside the battery is plated with three quarters inch plating worked on the beams, the deck planking being worked on top of the plating. This gives protection to the magazines, shell rooms, etc., from a dropping fire.

A very interesting feature in the designs for these armorclads is, that notwithstanding the double recessed form of the side at the hight of the main deck, the top sides along the upper deck are so arranged that they present a fair curved line to the eye, and so improve the appearance of the vessel on deck, very much from what it would have been had the recesses of the main deck not been worked out. On the upper deck bridges, the eye sees only the usual fair sides of an ordinary ship.

All the compartments of the double bottom, says *Engineering*, from whose pages we select the engraving, are made watertight; the athwartship bulkheads are provided with watertight doors, the iron platforms are also made watertight, and pumps, in connection with a system of pipes, are fitted so as to command each and every watertight compartment.



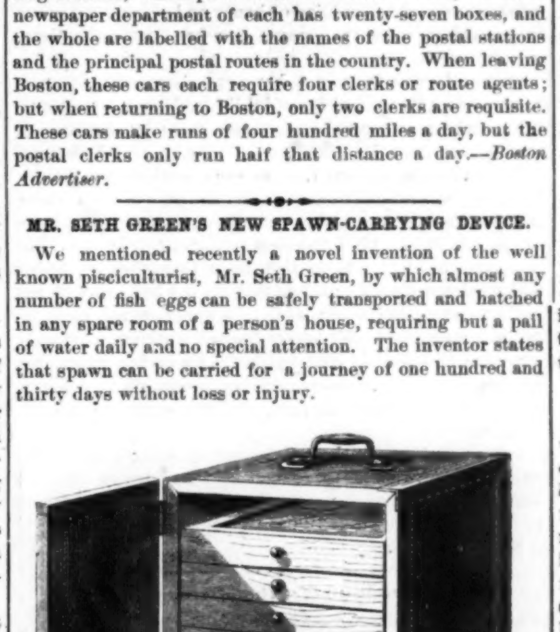
THE CHILIAN IRONCLAD ALMIRANTE COCHRANE.

Postal Palaces on Wheels.

Three cars, styled the "Palace Drawing Room Postal Cars of New England," have just been completed at Allston for the Boston and Albany Railroad Company. They are sixty feet in length, the longest on the road, are constructed of the choicest materials, are finished in hard wood in natural colors, and are provided with all the modern improvements ingenuity could suggest. A large and novel lamp, manufactured by the company, and having four burners and four large reflectors, is suspended from the roof of each car, giving ample light. About twenty feet in length of each car is partitioned as a store room for through mails, while the remaining space is divided into sections devoted to different purposes. The section in the middle is intended for letter sorting, another section is specially designed as a newspaper department, and still another section is used as a receptacle for bags, and is provided with racks, hooks, and other conveniences for facilitating the making-up of the mails. Each car is provided with water tanks and set bowls, similar to those in palace passenger cars. In the letter department of each car are four hundred and seventy boxes with wire netting bottoms, which prevent accumulation of dust, while the newspaper department of each has twenty-seven boxes, and the whole are labelled with the names of the postal stations and the principal postal routes in the country. When leaving Boston, these cars each require four clerks or route agents; but when returning to Boston, only two clerks are requisite. These cars make runs of four hundred miles a day, but the postal clerks only run half that distance a day.—*Boston Advertiser*.

MR. SETH GREEN'S NEW SPAWN-CARRYING DEVICE.

We mentioned recently a novel invention of the well known pisciculturist, Mr. Seth Green, by which almost any number of fish eggs can be safely transported and hatched in any spare room of a person's house, requiring but a pail of water daily and no special attention. The inventor states that spawn can be carried for a journey of one hundred and thirty days without loss or injury.



The apparatus consists of a simple wooden box, of a convenient size to be carried in the hand by means of the handle above. Its joints are covered with tin. Inside are numerous small trays made of wood, covered below with canton flannel. The upper tray, shown in the foreground, is provided with a hinged cover of the same materials. The spawn is placed upon the bottom of the trays, together with moss or seaweed, and kept moist. The temperature of the room may be so regulated that the spawn can be hatched in from fifty to one hundred and fifty days. Brook trout, salmon trout, white fish, and salmon eggs have been transported with success, over long journeys, by this means.

Vegetable Camp Followers.

Since the Franco-Prussian war it appears that a large variety of vegetation, formerly indigenous to Germany, has made its appearance and become acclimatized in French soil. No less than 163 new species have been found, and a remarkable conflict is going on between the natives and the invaders. The former, more robust and better suited to the climate, are defending their right to existence with much greater success than did the owners of the land on which they grow. On the plain of Bellevue, it is stated that, out of the great number of foreign vegetables which sprung up in 1871, hardly two species now remain. It is curious to compare this fact with the opposite condition of affairs in New Zealand and in the Pacific islands, where European plants are crowding out the aborigines, and even the people themselves are unable to hold their own against the stranger race.

The *Geographical Magazine* gives a number of remarkable instances in which vegetables have—as in the case first above noted—followed the movements of armies. Some of these examples are extraordinary and well worthy of more extended botanical investigation than they seem hitherto to have received. In their forays over Europe during the sixteenth and seventeenth centuries, the Turkish armies carried with them oriental vegetation. Up to the present day the ramparts of Pesth and of Vienna are covered with plants of Eastern origin. In 1809 a plant peculiar to the south and center of Europe, the *lepidium draba*, commonly called whitlow grass, was introduced into England, where it was hitherto unknown, by English troops returning from the disastrous expedition to Walcheren Island, on the Dutch coast. A portion of the army was disembarked at Ramsgate, and the straw from their bedding was thrown into an old marl pit belonging to a Mr. Thompson. The plant grew and spread in great profusion over Thanet Island, where, for a long period, it has been known as Thompson grass.

In 1814 the Russian troops carried with them herbs from the banks of the Dnieper and the Don into the valley of the Rhone, and even introduced the vegetation of the steppes into the environs of Paris. Several of these species still exist, perfectly acclimatized.

In 1872 the attention of French scientists was called to the fact that a number of plants, belonging to the Algerian flora and which served as forage for the French army in that colony, had made their appearance about the camps in France. Near Strasbourg, 24 species peculiar to African soil were found in a single bale of hay mown in the vicinity.

The latest contribution to curious information on this subject is found in a recent paper by Sir Bartle Frere, in which he mentions that the date tree, which is found on the coast of Mekron, in Africa, is confined to a narrow region. Inquiry into this leads him to give credence to the tradition that the tree was brought thither by the soldiers of Alexander, after their return from India.

The Middle Park Coal.

Professor E. J. Mallett says it possesses much in common with the recently discovered mineral called *albertite*, a species of solidified petroleum, and also with what is known as *torbanite*. These two varieties are highly valued by gas manufacturers, who mix from five to twenty per cent of these bituminous compounds with less bituminous coal, thereby greatly increasing the yield and quality of the gas. It resembles the former in the large amounts of gas and tarry oil it yields (which may prove as valuable as that derived from albertite), but differs from it in being heavier—the specific gravity of the albertite being 1·090, while this is 1·323—also in yielding no soluble products when treated with bisulphide of carbon, spirits of turpentine, ether, etc. From torbanite it differs, in not crackling in the fire, in being much heavier, and in melting and intumescing when heated. Analysis shows it to contain in one hundred parts 6·02 per cent of water and moisture, 39·95 per cent of volatile matter (gas and tarry oil), 54·03 per cent of fixed residue, consisting of coke and ash.

A Collision in Mid-Air.

Land and Water relates a very curious incident of a collision between two wild ducks in full flight. Whilst recently shooting on the dykes in Norfolk, five ducks were flushed out of shot; and while the gentleman who was on the lookout for them was watching their flight, in the hope that they would pitch again, two of them were observed to come into violent collision, one falling to the ground. It was so completely stunned that it was picked up by the gentleman in question, who found it to be a fine mallard, which, on examination, was discovered to have lost one eye, it having been previously destroyed by accident or disease. No doubt the loss of this organ was the cause of the very singular occurrence.

Correspondence.

A Strong Gunpowder.

To the Editor of the Scientific American :

Those who are familiar with the properties of chlorate of potassa know that it cannot be employed as a material in gunpowder, as it explodes under friction. Recent experiments, however, have convinced me that, under certain provisions, the salt may be used. For the experimental purpose the following directions are followed: Three things are employed, namely, chlorate of potassa, gum arabic (prepared in the manner to be described), and charcoal. Take gum arabic pulverized, add to it half its weight of black oxide of manganese; mix thoroughly: place in a glazed stoneware retort, and add strong nitric acid, diluted, and apply heat. Continue the heat until the mixture becomes a thick, tenacious mass; then pour off into shallow porcelain dishes, and evaporate to dryness. A thick, gluey, resin-like mass will remain, and here extreme care should be observed: for if the evaporating heat be in excess, the substance will ignite like gunpowder. When the gum is prepared, mix in the following proportions: Chlorate of potassa, 1 oz.; prepared gum, ¼ oz.; charcoal, 170 grains. Heat gently in an oven, and a powder is made which will not ignite under the hammer, as chlorate of potassa will when mixed with sulphur: yet, when ignited, it explodes with more violence than ordinary niter gunpowder.

I remember filling a gun cartridge with it, and discharging it. The hammer was driven back with such force from the recoil that the lock was injured. Whether this arose from some impediment of the bullet's progress through the chamber, or merely from the force of the explosion, I leave for others' consideration.

The manufacture of it appears simple; but it should be remembered that, in the preparation of the gum, if it be too much or not sufficiently evaporated, the powder will be a failure. Whether the above powder will stand the friction produced in grinding in a powder mill, I am unable to say.

Philadelphia, Pa. ELLSTAGLE.

Cheap Galvanic Battery.

To the Editor of the Scientific American :

I am using a battery much cheaper and (I believe) more permanent than the one described in your paper of January 30. It was set up by an Englishman in my employ, of the name of Baron, two years ago, and I have used this kind of battery ever since. It consists of a cylindrical glass vessel, eight inches deep and about the same in diameter. On the bottom of this vessel, a circular sheet iron plate is placed, with an insulated wire extending from the plate over the top of the jar. This plate is covered to the depth of one or two inches, with sulphate of copper. Another iron plate is suspended above the sulphate of copper, and soft water is poured in until the upper plate is covered, to the depth of one or two inches. Thus made up and the circuit completed, the battery will come up to its power in two or three days; but if needed to work at once, an eighth of an ounce of sulphuric acid should be added. The plates must be arranged horizontally one above another, and both must be of iron. If the upper plate is a quarter of an inch thick, it will last a year. These iron plates work just as well as zinc and copper, and can be had everywhere at a trifling expense. W. H. S.

Philadelphia, Pa.

Small Steam Engines.

To the Editor of the Scientific American:

The articles concerning the performance of small steam engines, which have appeared in your journal, are particularly interesting, and I hope that further communications on the subject will be published.

Some time ago I tried an experiment with a two horse power engine, in order to ascertain how it compared with the power of a horse. The latter, working in a treadmill attached to a 22 inch circular saw, was two hours in sawing a cord of pine wood, making four cuts and five sticks. The engine attached to the same saw performed the same amount of work in just forty-five minutes; the cylinder was 3½ inches in diameter by 6 inches stroke. Steam pressure was 35 to 40 lbs., and the revolutions of engine about 300 a minute. The power was transmitted through a 4 inch belt running from a 19 inch balance wheel on the engine, directly to the pulley on the saw. The horse could stand the work only part of the day at a time; but the engine was good for it every hour in the day and every day in the week.

Waltham, Mass. GEO. F. SHEDD.

Mill Dams.

To the Editor of the Scientific American:

Allow me to add a few facts to the communication published in your issue of January 23.

A dam of about 120 feet in length, across a small stream which was at times strong and rapid, had originally been built of flattened timbers, laid up in the form of a crib, and filled in with gravel; it thus constituted a bridge, except about 30 feet for waste water, which regularly flowed over. Year after year the gravel would be washed out by the water making its way between the timbers, causing leaks and requiring an annual expense for repairs. In 1819 I removed the timbers on the lower side of the dam, and dug about 3 feet deep to the hard pan for a foundation 8 feet broad, upon which a wall was carried up, 18 feet high, 8 feet thick at bottom, and 4 feet at top, the slope being wholly on the lower side. Immediately against this wall on the upper side, a puddling of clay was carried up, the whole hight of the wall, along with the general filling for the bridge and dam. In this clay puddling, broken stone was laid as in macadamizing a road; the stones were broken on the work itself, so that it was thoroughly pounded together. One year ago last summer, I saw that dam again (54 years after its construction); it was still in good condition, except that the stone had crumbled from the effects of frost and weather.

The point of improvement that I would suggest is the puddling and broken stone upon the upper side of the wall, as an effectual safeguard against leakage from the pond above, and consequent security against undermining from that source. J. W.

Canajoharie, N. Y.

Singular Mathematical Fact.

To the Editor of the Scientific American:

Under the above heading there appears in the SCIENTIFIC AMERICAN, for February 13, a rule for multiplying numbers by 5. There is nothing singular about it, as it is virtually multiplying by 10 and then dividing by 2, which is equivalent to multiplying by 5. The rule might be more simply and clearly stated thus: Annex a cipher to a number, and divide by 2.

There is no end to these "dodges" for abbreviating arithmetical processes. A convenient one, which I do not recollect to have seen in print, is a short way of squaring numbers ending with 5. It may be concisely stated thus: Multiply the tens (that is, the number with the last figure cut off) by the tens plus one, and annex the figures 25 to the product. Thus, to square the number 25, multiply 2 by 3, and affix 25, making 625. To square 195, multiply 19 by 20, and affix 25, or 38025. Any number of two figures can obviously be squared mentally. Thus $75^2 = 7 \times 8$ (or, really, 70×80) $25 = 5625$.

For a longer number, the work will stand thus:

$$\begin{array}{r} 43|5 \\ 43|5 \\ \hline 172 \\ 172 \\ \hline 1892|25 \end{array} \qquad \begin{array}{r} 61|5 \\ 61|5 \\ \hline 122 \\ 61 \\ \hline 732|25 \end{array}$$

This process may be readily explained algebraically. The square of $a+5$ (a representing any number of tens) is $a^2 + 10a + 25$. But $a^2 + 10a = a(a+10)$; that is, the product of the tens into the tens plus one ten.

When I first learned this rule, many years ago, it did not occur to me that it would often be of use; but I have found since that one does often have occasion to square numbers ending with 5, and the rule has saved me not a little time and figuring. R.

Cambridge, Mass.

Experiments with Honey.

To the Editor of the Scientific American:

The crystalization or candying of honey has received much study from apiarians; and a remedy has been sought, with no successful results. Light evidently has considerable influence upon this condition of honey, and placing the honey in a cool dark cellar for preservation has been many times recommended.

During the past autumn, I have experimented as follows: I put up six 1 lb. cans of beautiful linden honey, being careful to make it into one homogeneous mass by stirring. It was thrown from the combs by an extractor on July 20, and put into cans on August 1. The cans were placed respectively as follows: one in a dark, dry cellar, one each under shades of red, yellow, green, and blue glass, and the sixth can in full light. On November 8, the honey in the cellar candied to a white. November 22 to December 10, honey under colored shades candied, first in the red, next in the yellow, green, and blue; while the honey in full light remained transparent until January, when it soon candied after exposure to intensely cold weather. From my experience an equal temperature would preserve certain kinds of honey, while other kinds would candy under almost any circum stances.

I think that candied honey, instead of being looked upon with disfavor, should be recognized as evidently pure. I hope, however, that the above experiments will lead others to follow up the light theory with beneficial results.

Hartford, N. Y. SCIENTIFIC.

A Match under the Microscope.

To the Editor of the Scientific American:

Those of your readers who are fond of investigations with the microscope will find a beautiful object in the head of an ordinary parlor match.

Strike the match, and blow it out as soon as the head has fused sufficiently to cause protuberances to form on it; on that part of the head which took fire first, will be found a white, spongy formation, which, under the microscope and with a bright sunlight on it, has the appearance of diamonds, crystals, snow, frost, ice, silver, and jet, no two matches giving the same combination or arrangement.

Tarboro, N. C. H. A. WALKER.

A Railroad on the Ice.

To the Editor of the Scientific American:

The invention mentioned on page 85 of your current volume of a railroad on the ice, is a powerful effort of genius, and will do credit to Duluth; but, why use rails? Put a spiked tyre on each driver of the locomotive, remove the bogie, and put in its place a pair of sled runners fitted with steering gear, mount all your cars on runners, and—clear the track!

No rails will be left behind to absorb the heat of the sun and sink through the ice, or to be lost by a sudden thaw, or to be laid and removed. All this expensive track business will be saved. Duluth thought to save the grading, etc., but didn't think far enough. That city can just as easily save the rails and spikes too.

Permit me to thank you for the beautiful and convenient shape in which your paper now comes to hand. Old as it is as a publication, it seems to renew its youth, and to become brighter and better every year. C. E. T.

Washington, D. C.

The Transportation of Concentrated Sulphuric Acid.

The danger attending the transportation of concentrated acids renders it desirable to manufacture them as near the place of consumption as possible; but this is not always feasible—the acid must be transported. Its power of destroying both organic matter and the metals (except lead), in case a carboy breaks, is well known. Other phenomena, not so well known, have also been noticed, and are worthy of a brief description. A boat plying upon the river Rhine was laden with 600 carboys of sulphuric acid of 66° Baumé, and, owing to some misunderstanding between shipper and receiver, was obliged to remain laden for six or seven months. Some of the carboys were broken, by the rolling of the vessel or other cause, and the acid escaped into the hold of the vessel. Of course the wood work with which the acid came in contact was charred, and the iron nails, etc., were dissolved, endangering the safety of the vessel, which began to leak. The remarkable part of the story is yet to come: The iron work on the deck of the vessel was injured without having been in contact with the acid, and the boatman, who slept in the room where the acid was stored, was attacked with a severe inflammation of the eyes, and suffered from asthmatic difficulty.

Dr. H. Vohl conjectured that, through the action of the acid upon the straw and other packing, and upon the woodwork of the vessel, some volatile organic acids were produced, as well as sulphurous acids. To test the correctness of this surmise, he placed two pounds of cut straw in a large tubulated retort, and poured upon it just enough acid of 66° Baumé to moisten it. Heat was at once produced, the straw was carbonized, and suffocating acid vapors were evolved. No sulphurous acid was detected by the odor. A glass tube was inserted through the tubulus, reaching almost to the mixture; the gases were drawn, by means of an aspirator, through a solution of pure caustic potash, the operation being continued for four hours. An analysis showed that, in addition to small quantities of chlorine and sulphurous acid, a considerable amount of acetic, formic, and metacetonic acids had been absorbed by the potash. After the mixture of sulphuric acid and straw had been standing two days, the volatile acid products were examined, and it was then ascertained that the quantity of volatile organic acids had diminished, and that of sulphurous acid had increased. At the end of four days, the quantity of sulphurous acid was sufficient to be detected by the odor.

The same experiments were repeated with basket willow, pine and oak shavings, etc., with similar results. These experiments were all made at the temperature of about 50° Fah., without artificial heat. There is no doubt that, when concentrated sulphuric acid comes in contact with straw, wood, or other organic matter at ordinary temperature, volatile organic acids and sulphurous acid are developed in considerable quantity. In the case above described, these acid fumes, no doubt, attacked the iron parts of the vessel and made the boatman ill. Hence it is dangerous to sleep in a room where this acid is kept or transported, unless special care is taken to secure good ventilation.

Photographic Parasols and Wearing Apparel.

Among recent applications of photography is the imitation of lace, by photo printing on parasols. The *Photographic News*, speaking of one example, says: Every fiber of the lace was shown with extreme sharpness. So perfect was the result, indeed, that, unless one touched the parasol, it was impossible to believe that the lace was not actually a tangible reality.

The same process is now being further employed for printing handkerchiefs and shirts; and we were fortunate in seeing the other day some examples of what can be done in this delicate fancy printing process. Some handkerchiefs shown us had at the corner two or three butterflies most charmingly impressed, the images having evidently been taken direct from the insects themselves. Other fabrics had sketches, evidently reproductions from woodcuts and engravings, obtained and printed by a photo-mechanical process, all of them being of a most delicate nature, such as could hardly be secured from blocks on lithographic stones. Photographic portraits of various kinds were also to be seen impressed upon fabrics in the same way; but these, perhaps, can scarcely be called novelties, neither was the result so successful as in the case of the other objects we have mentioned. The prints were undoubtedly all produced by fatty ink, and would, no doubt, be very permanently printed upon the fabric. This method is much simpler and more satisfactory than printing in the ordinary way by silver salts; for very great care has to be exercised in the latter case, and failures are far from unfrequent, the dressing in the fabric being most difficult to remove and apt to discolor the silver print. Moreover, there are the troublesome operations of salting and albumenizing, and flattening the stuff, which is by no means an easy proceeding, any more than the examination of the print in the pressure frame. This photo-mechanical printing upon fabrics is certainly an art to be cultivated

PRACTICAL MECHANISM.

NUMBER XVIII.

BY JOSHUA ROSE.

MOVEMENT OF THE PISTON AND THE CRANK.

To resume, then, we find that, under a maximum of steam lap, the valve permits, as before stated, the steam to exhaust too early in the stroke, and that, to remedy this defect, we have no alternative but to add lap on the exhaust side of the valve. To do this, however, would reduce the exhaust opening of the cylinder exhaust port; hence some alteration in the proportions of the openings is necessary to enable us to accomplish our end, which alteration is in making the cylinder exhaust port more than twice the width of the steam port, since exhaust lap can only be usefully employed under such conditions. In order to show the benefits due to exhaust lap, we will again alter our engine, giving the steam side of the valve an additional one sixteenth of an inch of lap, and placing seven sixteenths of lap on the exhaust side; hence our next experimental engine will have the following dimensions: Steam ports seven eighths of an inch wide, ribs (or bridges) each five eighths of an inch wide, cylinder exhaust port two and one quarter inches wide, exhaust port of valve two and five eighths inches wide, steam lap fifteen sixteenths of an inch, exhaust lap seven sixteenths, travel of valve three and nine sixteenth inches, eccentric rod twenty-three and three quarters inches long.

The only disadvantage arising from these alterations will be that, in consequence of widening the cylinder exhaust port, we have thrown the steam ports wider apart, and have hence had to widen the valve, and therefore to increase the area of the back of the valve upon which the steam acts, pressing the valve to its seat; so that we have proportionately increased the friction due to moving the valve under its pressure: unless the valve is balanced, in which case the increase of area makes no appreciable difference. We have, on the other hand, shortened the length of the steam passages to the amount to which we have widened the cylinder exhaust port, and gained several other important advantages, as the following tables of movements disclose:

TABLE NO. 15.—FRONT STROKE.

Piston moved inches	Port open inch	Piston moved inches	Port open inch
1	5-8	7	7-16
2	3-4	8	1-4
3	3-4	9 1-8	closed, and expansion begins
4	3-4		
5	11-16	11 3-4	closed, but expansion ends
6	5-8 bare		
		12	exhaust port open 9-16 inch

TABLE NO. 16.—BACK STROKE.

Piston moved inches	Port open inch	Piston moved inches	Port open inch
1	3-4	6	7-16
2	7-8	7	1-4
3	7-8	8	closed, and expansion begins
4	3-4		
5	5-8	11¼	closed, but expansion ends
		12	exhaust port open 5-8 inch

In the table No. 11 given in our last, we find that the widening of the cylinder exhaust port and the addition of lap on the exhaust side of the valve has retained the steam in the cylinder during three eighths of an inch more of the piston movement in the front stroke, and during one half of an inch more in the back stroke than was previously the case; and further, that we have used the steam expansively during half an inch more of the front and during seven eighths of an inch more of the back stroke than in our last engine, the steam supply in the front stroke having been cut off a trifle earlier and the expansive steam retained longer in the cylinder. In the back stroke, however, the steam supply is cut off five eighths of an inch earlier in the stroke and the expansive steam exhausted half an inch later in the stroke, so that the back stroke has been benefited far more, by the alteration, than has the front stroke.

We shall find, however, on examination that the average width of the port opening for the admission of steam has been slightly reduced; this, however, is not of great consequence, since the ports have (as before stated) a larger area than they require when in operation as steam ports; so that, if the exhaust is found to be as free as before, the last alteration of our engine will have been beneficial in every respect.

TABLE NO. 17.—EXHAUST OF STEAM AT FRONT END.

Piston moved inches	Exhaust A, (Fig. 54,) open inch	Cylinder Exhaust B, (Fig. 54,) open inch
11 7-8	1-8	1 15-16
12	9-16	1 9-16
Return stroke		
1	7-8	3-4
2	7-8	5-8
3	7-8	5-8
4	7-8	3-4
5	7-8	7-8
6	7-8	1 1-16
7	7-8	1 1-4
8	5-8	1 1-2
9	5-16	1 13-16
9 3-4	closed, and steam cushions.	

In order to obtain the average exhaust opening during the the stroke, we must of course, at each inch of piston movement, take the port opening of A or B (as the case may be), which is the smallest; commencing, then, when the piston is at the end of the stroke, a calculation will give us eleven sixteenths of an inch as the average exhaust opening in our last table, against ten sixteenths as the average exhaust shown in table No. 13.

TALLE NO. 18.—EXHAUST OF STEAM IN BACK END.

Piston moved inches	Exhaust A. (Fig. 54,) open inch	Exhaust B, (Fig. 54,) open inch
11 3-4	1-8 full	1 7-8
12	5-8 barely	1 7-16 full
1	7-8	7-8
2	7-8	3-4
3	7-8	3-4
4	7-8	3-4
5	7-8	13-16
6	7-8	7-8
7	7-8	1 1-16
8	13-16	1 1-4 full
9	1-2	1 9-16
10	3-16	1 7-8
10 9-16	closed, and steam cushions.	

The average exhaust of the above is one hundred and thirteen one hundred and sixtieths of an inch against the average of one hundred and sixteen one hundred and sixtieths of an inch, shown in table No. 14, which shows a slight loss in our last experiment; this is, however, an apparent and not a real loss, for the reason that, in our last experiment, the steam was cut off earlier in the stroke, so that the quantity of steam to be exhausted was less than in the former instance; hence the exhaust opening, in our last experiment, when considered with relation to the quantity of steam required to pass through it in a given time, becomes greater than was formerly the case. It will also be observed that the exhaust in our last experiment is (in both strokes) more free during the early part of the stroke, that is to say, from the first to the fifth inch of the piston movement, than was the case in our previous experiment, which is a gain of great value, since it is during that part of the stroke that the exhaust opening is at its least, from the partial closure of the cylinder exhaust port.

In the front stroke, at the nine and three quarters inches, and in the back stroke, at the ten and nine sixteenths inches of piston movement, the exhaust is closed so that whatever steam, on the exhaust side of the piston, remains in the cylinder at those points is compressed by the advancing piston, and acts as a cushion to reverse the motion of the reciprocating parts of the engine, easily and without noise (in the same manner as the same end is obtained by giving lead to the valve). It is the lap on the exhaust side of the valve which causes this partial closure and compression of the exhaust steam (which is commonly called cushioning on exhaust lap), and which effects a saving of steam, inasmuch as it may be so proportioned as to enclose and compress sufficient steam to just fill the steam passages with steam at full pressure by the time the piston has arrived at the end of its stroke; so that, when the valve opens, no steam will be required from the steam chest to fill such passages, and the valve need not therefore be given any lead, which, in turn, leads to another advantage, inasmuch as, to take the lead off the valve, we must set the eccentric back so that its throw line will be more nearly at a right angle to the center line of the crank, and the variation in the valve movement (explained in Fig. 53 and its accompanying remarks) will be less. By taking the lead off the eccentric, we however decrease the opening of the steam port during the first two inches of the piston movement, which is a decided disadvantage, even though the average opening of the steam port remains the same in either case, because the closure of the port of the valve is proportionately delayed.

The extreme limit to which the addition of steam lap, the widening of the cylinder exhaust port, and the addition of exhaust lap may be usefully employed is governed by, first, the exhaust opening becoming diminished when the piston is at the end of the stroke and during the latter part of the exhaust; secondly, by the increased pressure of the valve to its seat (already referred to); thirdly, by a proportionate increase in the travel; and fourthly, by the point in the stroke at which the exhaust lap will close the exhaust port, and thus shut in and compress a portion of the steam, on the exhaust side of the piston, in the cylinder: it being evident that, if the quantity of steam so enclosed be excessive, the piston will compress it to such an extent as to make its pressure, by the time the piston has arrived at the end of the stroke, greater than is the pressure of the steam in the steam chest, and of course very much greater than the pressure of the steam on the steam side of the piston (which has decreased in consequence of its expansion), thus entailing a serious back pressure, and causing the steam compressed in the steam passage to be forced back into the steam chest so soon as the valve opens. It is obvious, however, that if the valve has any lead on it, this back pressure will be less than if there were no lead, because the steam would be forced back into the steam chest earlier, and therefore before it was compressed to so great a degree; but in either case sufficient exhaust lap to cause such steam to be forced by the piston back into the steam chest would entail a loss of power from back pressure, and place a severe strain on some of the parts of the engine, as already explained in our remarks on excessive lead.

To illustrate these points let us alter our engine as follows: Steam ports seven eighths of an inch wide, ribs five eighths of an inch wide, cylinder exhaust port two and three quarters inches wide, steam lap one and one eighth inches, exhaust lap three quarters of an inch.

These alterations necessitate that the valve travel be increased from three and nine sixteenths inches to four inches, causing an increase in the distance traveled by the valve, and therefore in the power employed in moving it, of over 12 per cent (unless the valve be balanced).

The valve will now be eight instead of seven and one eighth inches wide as before, causing it to be pressed to its seat with over 12 per cent more pressure than before. The exhaust opening will be diminished as follows (those points in the stroke here omitted not being affected by the change)

TABLE NO. 19.—EXHAUST AT FRONT END.

Piston moved inches	Exhaust open inch	Loss inch
12	1-2	1-16
Piston returned		
7	5-8	1-4
8	5-16	5-16
9	exhaust closed, cushioning begins	

TABLE NO. 20.—EXHAUST AT BACK END.

Piston moved inches	Exhaust open inch	Loss inch
12	3-8	1-4
Piston returned		
7	3-4	1-8
8	9-16	[illegible]
9	1-4	1-4
9 7-8	exhaust closed, cushioning begins.	

Here, then, we have a large decrease in the exhaust openings, and have cushioned on exhaust lap three quarters of an inch earlier in the front stroke and eleven sixteenths of an inch earlier in the back stroke: the other alterations being that the expansion of our new engine will begin at eight and three quarters inches of the front and at seven and five eighths inches of the back stroke, that is to say, the steam has been used expansively during five eighths of an inch more of the piston movement during the front, and during five eighths of an inch more of the back stroke than was the case previous to the last alteration made in our engine. The effect of such a movement would be to place an amount of back pressure (due to cushioning on the exhaust side to an excessive degree) so great as to force the valve off its seat and produce a serious strain upon the engine, and to produce a back pressure during the earlier part of the exhaust by cramping it.

Exhaust lap, sufficient to prevent the exhaust from taking place too early in the stroke, is shown by our tables to be in every way desirable; but when it is employed to cushion, or, in other words, to answer the purpose of lead, great care must be taken as to its proportion, which must, in all cases, depend upon the pressure of the steam used, and the speed at which the piston travels. With high pressures and speeds, a minimum only of exhaust lap is permissible. Another effect of exhaust lap is to take some of the lead off the eccentric, and to that extent to correct the irregularity in the points of cut-off, expansion, etc.

It will be observed that the variation in the point of cut-off at one end, as compared to the other end of the stroke, becomes greater in proportion to the increase of steam lap; and there is no way of remedying this defect except we produce still greater evils in other directions. Were we to equalize those points of cut-off by giving different amounts of steam and exhaust lap at one, as compared to the other, end of the valve, we should increase the variation in the steam and exhaust openings, and cushion at widely differing points in the stroke; so that, when we have proportioned the steam lap to cut-off at about three quarters of the stroke, and the exhaust lap so as to leave the exhaust port open (when the piston is at the end of the stroke) to the amount of about two thirds of the full width of the steam port, we have obtained all the benefits due to the employment of either of them, nor can we alter the value to accomplish a gain in any direction without entailing a loss in another.

If the cylinder exhaust port is twice the width of the steam port, and no exhaust lap is employed, the valve may have steam lap to about the width of the steam port; but if the cylinder exhaust port is made more than twice the width of the steam port, a proportionate amount of steam and exhaust lap may be added. For locomotives, common proportions are: Steam ports one and one quarter inches wide, rib one inch, cylinder exhaust port two and one half inches, steam lap one inch, lead of valve three sixteenths of an inch, travel of valve four and one half inches, exhaust lap being dispensed with, except it be sufficient to just prevent communication between the steam ports when the valve is in the middle of its travel.

Actinic Light.

The *Athenæum* says: "When the vapor of bisulphide of carbon is mixed with nitric oxide gas, the mixture, on ignition, burns with an intensely luminous flame of high actinic power, but of only momentary duration. MM. Delachanel and Mermet have, however, recently succeeded in producing a lamp in which this gaseous mixture may be conveniently burnt, and thus applied to photographic purposes. The nitric oxide is generated by the action of iron on a mixture with vapor of bisulphide of carbon; the mixed gases are burnt in a kind of Bunsen's burner, the products of combustion being rapidly carried off by a chimney. For the purposes of the photographer, this new flame is said to be superior to that of the magnesium lamp, while it is estimated to have twice the chemical power of the oxyhydrogen flame, and three times that of the electric light.

AN interesting phenomenon is now observed in Cadunk, Lily and Lake ponds, at Southington, Conn. Decomposition of vegetable matter on the bottom is producing carburetted hydrogen gas, which may be ignited at this season by applying a match at holes made in the ice.

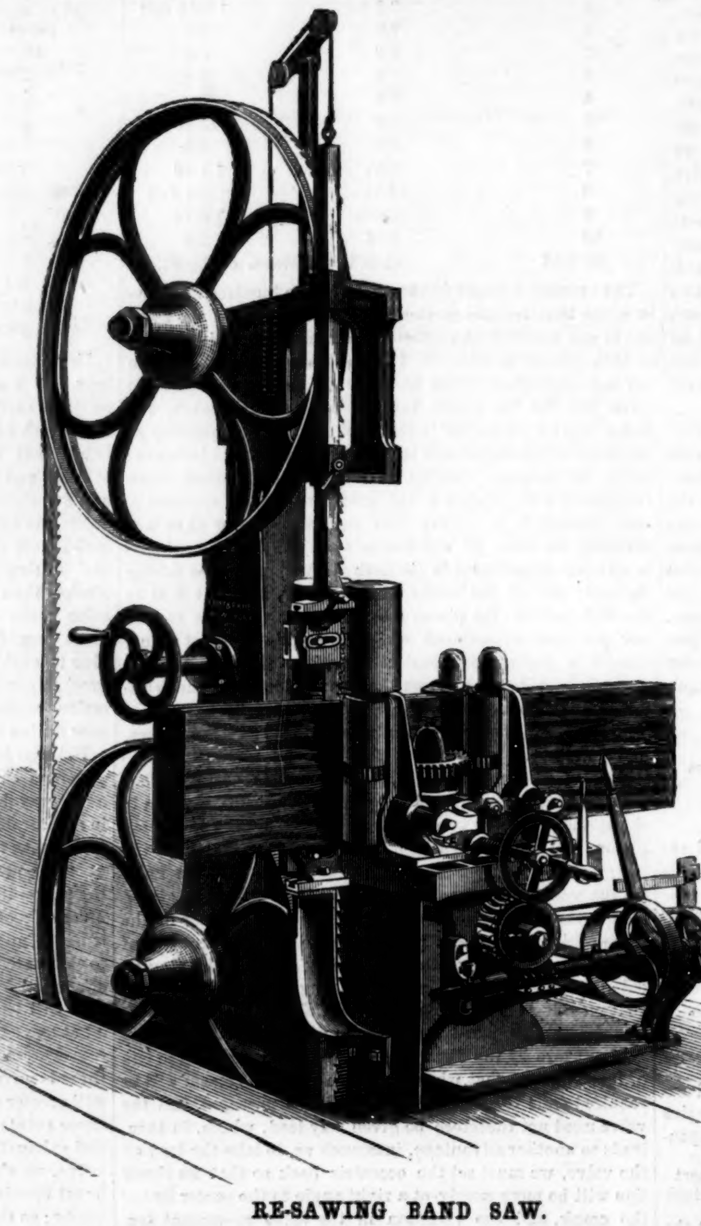
RE-SAWING BAND SAW

The annexed illustration represents a new and improved band saw, designed exclusively for re-sawing. After several years spent in experiments and trials, to construct a machine for the above purpose, Messrs. First & Pryibil, of 461 to 467 West 40th street, New York city, a well known firm manufacturing band saws and other woodworking machinery, have succeeded in getting a machine giving full satisfaction, and they have at present several of them in operation.

The capacity of the machine, shown in the engraving, the manufacturers state, is from 12,000 to 16,000 feet of lumber per day. The hight of the machine is 10 feet; the wheels are 5 feet in diameter; the weight is between 4,000 and 5,000 lbs. The saw kerf made is from $\frac{1}{16}$ to $\frac{3}{32}$ inch thick, and its sawing space is 30 inches, taking in timber 18 inches thick.

As lumber has become costly, it will be seen that it is of great advantage to use a thin blade; the saving of power is also considerable. On hard lumber, the saving amounts to more than the sawing costs. The general construction will be readily understood from the engraving.

Further particulars may be obtained by addressing the manufacturers as above. On page 141 will be found an advertisement of this machine, and a copy of the manufacturers' correspondence with the Managers of the American Institute.



RE-SAWING BAND SAW.

On the Motive Power of Diatoms.

Professor Leidy, in some remarks on the moving power of diatoms, desmids, and other algæ, stated that, while the cause of motion remains unknown, some of the uses are obvious. The power is considerable, and enables these minute organisms, when mingled with mud, readily to extricate themselves and rise to the surface, where they may receive the influence of light and air. In examining the surface mud of a shallow rain water pool, in a recent excavation in brick clay, he found little else but an abundance of minute diatoms. He was not sufficiently familiar with the diatoms to name the species, but it resembled *navicula radiosa*. The little diatoms were very active, gliding hither and thither, and knocking the quartz grains about. Noticing the latter, he made some comparative measurements, and found that the naviculæ would move grains of sand as much as twenty-five times their own superficial area, and probably fifty times their own bulk and weight, or perhaps more.

A NEW PIE MARKER.

The form of this device is plainly shown in the annexed engraving. The stamping portion may be made of any desired shape and of any suitable material. Its object is to give an ornamental appearance to pies, cake, or butter, and it will be found a handy little device for the purposes.

It was patented December 23, 1873, through the Scientific American Patent Agency, to Mr. Thomas S. Macomber, of Hamilton, N. Y., who may be addressed for further particulars.

Look well to the little things, and the larger ones will take care of themselves

Electrical Resistance of Various Metals.

M. Benoit has measured with great precision the electrical resistance of various metals at temperatures from 0° to 860°. He employed both the method of the differential galvanometer and of the Wheatstone's bridge, and for each metal has measured several specimens. The mean of these is given in the following table, the second column giving the resistance of a wire, 39·37 inches long and having a cross section of 0·03 inches, in ohms, and column three the same quantity in Siemens units. Column four gives the resistance compared with silver:

Metal.	Ohms.	Siemens.	
Silver, A.	0154	·0161	100
Copper, A.	·0171	·0179	90
Silver, A.(1)	·0193	.0201	80
Gold, A.	·0217	·0227	71
Aluminum, A.	·0309	·0324	49·7
Magnesium, H.	·0423	·0443	36·4
Zinc, A., at 350°	·0565	·0591	27·5
Zinc, H.	·0594	·0621	25·9
Cadmium, H.	·0685	·0716	22·5
Brass, A.(2)	·0691	·0723	22·3
Steel, A.	·1099	·1149	14
Tin	·1161	·1214	13·3
Aluminum bronze, A. (3)	·1189	·1243	13
Iron, A.	·1216	·1272	12·7
Palladium, A.	·1384	·1447	11·1
Platinum, A.	·1575	·1647	9·77
Thallium.	·1831	·1914	8·41
Lead	·1985	·2075	77·60
German silver, A. (4)	·2654	·2775	5·80
Mercury	·9564	1·0000	1·61

A, annealed; H, hardened; (1) silver ·75; (2) copper 64·2, zinc 35·1, lead 0·4, tin 0·4; (3) copper 90, aluminum 10; (4) copper 50, nickel 25, zinc 25.

These results, which are all taken at ·0, agree closely with those obtained by other observers. M. Benoit has extended his observations to a range of temperature much greater than those previously employed for this purpose. He wound the wire around a clay pipe inclosed in a muffle, and immersed the whole in a bath of water, mercury, sulphur, or cadmium, which was kept at the boiling point by a Perret furnace. Constant temperatures of 100°, 360°, 440°, and 860° were thus obtained. Various temperatures below 360° were also obtained by a mercury bath. The measures were also corrected for expansion. Plates annexed to his memoir, presented to the Faculty of Sciences of Paris, show the results graphically. They show that the resistance increases regularly for all metals like tin, lead, and zinc up to their points of fusion. This increase, however, differs for different metals. We notice that tin, thallium, cadmium, zinc, lead, are found together in the upper part of the plate; at 200° to 230°, their resistance has doubled. Below them are iron and steel; for the last, the resistance doubles at 180°, quadruples at 430°, and at 860° is about nine times that at 0°. Palladium and platinum, on the other hand, increase much less, and only double their resistance at 400° to 450°. Gold, copper, and silver form an intermediate group. In general, the conductibility decreases more rapidly in a metal the lower its point of fusion. Iron and steel are exceptions to this rule. In alloys the variation is always less than in their constituents, and this is especially the case with German silver.

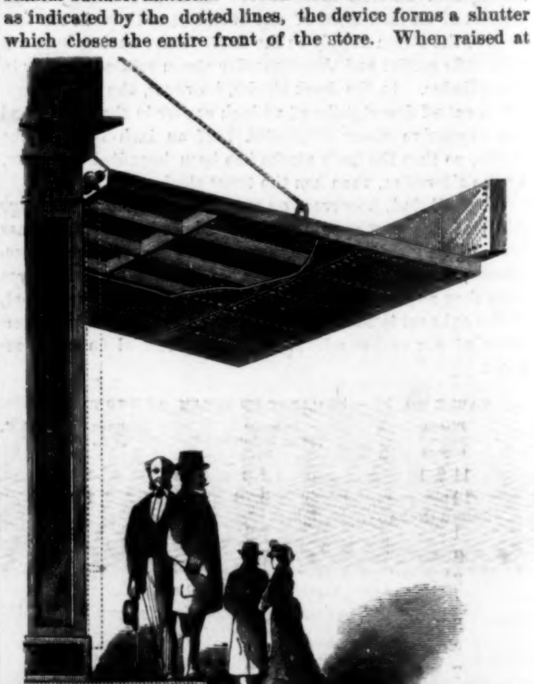
A Curious Artificial Fish.

A Spaniard named Fernandez, says a contemporary, has constructed at San Francisco a submarine propeller, eleven feet long, four feet deep, and four feet wide, and resembling a monitor in its general shape. A forward hatchway opens into a cistern which will hold forty gallons of water, introduced and expelled by means of a force pump inside the boat and under control of the operator. The water passes in both instances through a hole perforated amidships under the keel. When the operator desires to sink his vessel he fills the cistern with water, and when he wishes to ascend he empties it. By means of complex machinery, he is enabled to steer his vessel in any direction, and with remarkable rapidity. The hexagonal manhead or trunk, which looks like the turret on a monitor, is three feet long and from one to two feet wide. It is closed over with a hatch cover, held down inside by two iron claws, which are secured by iron rods. A slight pressure on these rods in a given direction instantly loosens the claws and the hatch cover springs open. In this way the inventor purposes escaping from his boat, should anything go wrong with the machinery. The manhead has five small apertures for light, four of the six sides and the top having windows of French plate glass. On either end of the manhead, extending upward several feet, are two wrought iron rods, intended to facilitate the escape of the operator in danger, who uses them to force himself from his place. To the aft rod is connected a contrivance which makes the upper section airtight, and the operator, can, by it, expel the foul air.

IMPROVED AWNING.

The device herewith illustrated serves, when raised in suitable position, as an awning for the exterior of a store; and when lowered, may be used as a single large shutter. The construction and arrangement, as will be seen from the following description, are necessarily suited to both purposes.

To a large inner section, which is hinged directly to the building, a smaller outer section is similarly attached. Both sections are composed of a framework, the pieces of which are set at right angles, so as to form square or rectangular air chambers. The frame is covered with sheet iron, tin, or similar suitable material. When both sections are let down, as indicated by the dotted lines, the device forms a shutter which closes the entire front of the store. When raised at



an inclination to serve as an awning, the outer section is allowed to swing from its hinges for the purposes of a sign.

The invention is simple and convenient, and, doubtless, will be found an economical substitute for the appliances which it is designed to replace. Patented December 1, 1874, to Martin Stonehocker, of Streator, La Salle county, Ill., to whom letters for further information may be addressed.

Manufacture of Extract of Indigo.

To make what is generally called sour extract of indigo, mix 5 lbs. of best Bengal indigo in 30 lbs. of strong oil of vitriol. Let it stand five days; then put it in a tub and add 40 gallons of boiling water to it; then filter while hot through strong felt cloth. The filters are usually made this way: A frame like a table top, 8 yards long, 2 yards wide. This frame is divided into four filters. Pieces of wood across are put on the top and made to fit the holes (the shape of bowls, with small holes perforated in them); then the felt cloth is put on the top, and the liquid is put on the filter and filtered through. The sediment at the top is used to color pottery molds; that which runs through is put in a tub, and 40 lbs. of common salt added. Digest for six hours; then put on the filters again for four or five days. That which drains through runs away into the sewers; that on the top of the filters is the extract. For these proportions the extract should weigh 80 lbs. This is sour extract of indigo of commerce.

FREE EXTRACT.—To make free extract of indigo, put 100 lbs. of the sour extract in a tub, 12 gallons of water as well. Neutralise the acid in the extract with strong soda ash liquor until it is free from any sour taste; then put on the filters for six days. It should weigh 100 lbs. when it comes off. That is free extract of indigo of commerce.—*Chemical News.*

PUBLIC BUILDINGS IN BRUSSELS.

The Belgian capital contains, without doubt, more fine public buildings than any other city of its size; and its bright appearance, and the general aspect of brilliance and gaiety of its inhabitants, have gained for it the name of "the miniature Paris." A new boulevard, which traverses the city, is now completed; and the principal building situated on it, the new Exchange, was opened last year with a grand ball, at which the King and Queen and other celebrities were present, in all some 3,500 persons, so that, although the floor of the great hall occupies some 4,000 superficial yards, the dancers were much cramped for room. M. Léon Suys is the architect of the building, which was begun in 1868. It is 300 feet long by 150 wide; it is rectangular shaped, and its principal façades open on the Boulevard Central and the Rue du Midi. The style is mixed, the architect has united the types of various ages, iron is found in complete harmony with stone, and the result is a splendid hall of commerce, a saloon which can at any time be converted into a theater, one of the most capacious concert rooms on the Continent, and a trophy of almost dramatic elegance. The sculptural ornamentation is very rich. The frontispiece of the great peristyle represents the city of Brussels, surrounded by groups of allegorical figures—Industry, Agriculture, Peace, Navigation, Painting, Free Trade, etc. Many other groups to sculpture decorate the outside of the building, which is surrounded by a large dome, culminating in a gilt spire. The immense cupola, says *Harpers' Weekly*, from which we extract the engraving, is supported by twelve Corinthian column in reddish gray stucco, while the galleries rest on columns imitating dark red porphyry. The floor is a masterpiece of mosaic work, executed by Italians. The sun burners, by which this magnificent structure is lighted, are composed of 1,400 jets of gas.

Solders and Soldering.

Continuing our remarks on this subject (see page 112), we have now to speak of hard solders and of the methods employed to solder other metals than tin, lead, and zinc. Probably the most important of these methods is that known as brazing, that is, the process employed for uniting pieces of iron, steel, copper, etc., by means of a solder consisting of brass, or an alloy of copper and zinc in different proportions. This solder is technically termed strong or hard solder. In workshop parlance, this is denominated spelter, a name which in commerce is used to designate the bars or ingots of cast zinc, as received by the metal merchant. Although this use of one name to indicate two very different things is at times confusing to the tyro, there is little fear that he will be misunderstood in the workshop or by tradesmen if he asks for his hard solder under the name of spelter. It is of far more importance, however, to remember that, for some kind of work, commercial spelter is not so well suited as other brasses; for it ordinarily consists of equal weights of zinc and copper, and in certain cases it is advisable to use a harder solder than is obtained by these proportions. The admixture of copper and zinc produces a series of alloys differing considerably in their qualities; and when tin is introduced, the increase or decrease of the zinc and tin produces a compound metal, the properties of which are widely different according to the relative quantities of the ingredients used in its production. Spelter when home made is best prepared by melting the copper and zinc in separate crucibles, the copper being in a crucible large enough to hold the zinc as well. When both metals are thoroughly melted, the zinc is poured into the copper crucible, the two being stirred well, so as to ensure thorough admixture, when the alloy is poured out on to a bundle of birch twigs or pieces of coarse basket work, supported over a tub of water, the object being to obtain the solder in form of fine grains with an irregular crystallization. If, when taken from the water, the spelter is not sufficiently uniform in size of grain, it is sifted through a sieve, and the large particles are crushed in a cast iron mortar or any suitable appliance, and again passed through the sieve, for fineness and uniformity of size are essential to the accomplishment of some examples of brazing in a thoroughly satisfactory manner. The manufacturers of the hard solder, however, usually cast it into ingots, delaying the cooling in order to develop as much as possible the crystalization, which is found to facilitate the subsequent crushing and sifting of the spelter. The flux used in nearly all the operations performed with hard solder is borax—the biborate of soda—which not only prevents the surfaces of the metals from becoming oxidized, but also exercises the remarkable property of dissolving any oxide already there. In some cases the flux can be dispensed with, but the pieces to be joined must be filed perfectly bright and clean, and care taken to melt the solder as quickly as possible when heat is once applied. The handiest way is, however, to dissolve the borax in water and add the solder, forming a paste which can be easily spread on the surfaces of shapes to which the drier powder would not readily adhere. For many jobs, however, it will be sufficient to merely crush the borax, which contains in its uncalcined state a considerable quantity of water; and for others it will be best to use merely a solution of borax.

The ordinary proportions of the constituents of hard solder are usually stated to be:

	Copper.	Zinc.	Tin.
Hardest	3	1	—
Hard (spelter)	1	1	—
Soft	4	3	1

and softer still is no longer a brass, but an alloy of tin and antimony (2 to 1). By the rough and ready processes of the manufactories, however, these proportions are probably never very accurately observed; and a variation of a few parts per cent is, perhaps, of little moment, when copper and zinc alone enter into the alloy. Thus, for solder for iron, the zinc may be present in the proportion of from 33 to 50 per cent, though the harder solder (that with least zinc) is to be preferred. For soldering brass and copper, the ordinary spelter will answer for common work; but where, as in the case of, say, microscope tubes, it is desirable that the solder should be as nearly as possible of the same color as the brass, the proportions of zinc must be increased or decreased, according to the paleness or yellowness of the metal to be soldered. In a similar manner, it is often advantageous or advisable to study the hardness of the solder, and to keep the zinc as low as possible to secure fusibility, without running the risk of damaging the article to be soldered. Thus for brazing tubes of pure copper, the zinc may be as little as 25 per cent, or even less; or a solder composed of copper 7, zinc 3, and tin 2, may be employed. For uniting brass tubes, that are to be afterward bent and hammered over the soldered portions, an alloy of brass 77·5, zinc 22·5, will be found to yield better results than other hard solders; but if the tubes are thin, and have to be soldered to flanges or pieces of stouter substance, it will be advisable to add a little tin—from 2 to 5 parts—in place of a similar quantity of zinc. Where, however, a large amount of work has to be done with the same kind of brass, the very best solder that can be had is to take the scraps of the metal itself, and add zinc in the proportion

THE NEW BOURSE AT BRUSSELS, BELGIUM.

of 20 per cent, thus producing an alloy whose fusion point is sufficiently removed from that of the metal to be soldered to avoid risk of damage; and yet it approaches so closely to it as to insure perfect union of the solder and the brass. A fine, hard solder, for joining small and thin pieces of copper or brass, consists of copper 86·5, zinc 9·5, tin 4. It is a light yellow in color, and is easily reduced to a fine grain, resembling filings; but it speedily oxidizes when heated, and should be well mixed with borax, unless it is completely surrounded by the fire. A solder for pure copper is made by mixing lead and copper, in proportions varying from 16 to 25 parts of the former to 100 of the latter. These are prepared by first melting the copper, and then the lead in a separate crucible. Add the lead as soon as melted, stir quickly, and pour out, either into ingot molds or on the bundle of birch twigs over the water tub. These solders can be used without borax, for brazing copper.

Solders for gold necessarily vary with the quality of the gold they are required to join. For 18-carat and upwards, the usual solder consists of gold (18-carat) 9 parts, silver 5, copper 5, and is best when made from filings of the components, melted together. Gold solder, termed one fourth, consists of gold 3, alloy 1; one third, of gold 2, alloy 1; and one half, of gold 1, alloy 1. The alloy is generally composed of 2 parts of silver to 1 of copper; but in one half solder the silver and copper are in equal proportions. A solder for the commoner articles of gold is make by fusing gold 3 parts, silver 2, copper 1¼, together, and then adding ⅛ a part of zinc. Stir and cool immediately. This solder will flow at a comparatively low temperature. A soft gold solder is composed of gold 4, silver 1, copper 1. A solder for articles of 12 to 16 carats is made of gold 24 parts, silver 9, copper 6, and brass 3, the latter being a more convenient way of adding a small quantity of zinc than by putting that metal in its uncombined state into the crucible containing the molten metals. The brass, however, should be added when the others are melted.

A hard solder for silver consists of silver 66, copper 23, zinc 10; and being more fusible than "middling hard" solders for copper, it does well for brazing the finer articles in brass and steel. Silver solders are composed of 5, 3, and 2 parts of silver to 1 of brass, and are called respectively one sixth, one fourth, one third. The alloys should be melted several times in order to secure homogeneity, and are best when they are subsequently laminated into thin strips, which are granulated into spangles ready for mixing with the borax. A white solder for silver is made of equal parts of silver and tin. If an article of silver is to undergo several soldering operations, it will be necessary to employ the richer or less fusible solders, first, so as to avoid displacement in the subsequent applications of heat. There are other silver solders which are found useful in certain kinds of work. One of these is generally used for plated ware, and consists of silver 2 parts, bronze 1; another of silver 4, bronze 3, and arsenic 0 25; or equal parts of silver, bronze, and arsenic may be used. A solder consisting of silver 2, Dutch gold 1, and arsenic 0·5, is also found valuable; but in all these, the arsenic must be added after the fusion of the other metals. The button is to be drawn out under the hammer, or laminated and cut into shreds or spangles for more complete incorporation with the borax. A solder for German silver is easily made by melting scraps of the metal to be soldered, and adding an equal weight of molten zinc to them in the crucible; but this alloy is more ductile the smaller the proportion of zinc is. For general purposes, however, 5 German silver to 4 zinc will be found best. This should be cast into plates, cut into pieces, and pulverized.

For articles of aluminum bronze, three solders may be tried; but the proportions vary with the nature of the work and the number of operations the article has to undergo. A hard solder for aluminum bronze is expensive, containing about 88 parts of gold, 6 of silver, and 6 of copper; a "middling hard," about 54 gold, 28 silver, and 18 copper; and a "soft," 14 parts of gold, 57 silver, 15 copper, and 14 brass—the latter being added for the sake of the zinc it contains.

For soldering platinum, pure gold is generally used, but sometimes about a half per cent of an alloy of platinum and iridium is added to it

It should be remembered that all solders deteriorate by remelting; and though waste scraps may be added to a new melting, if the work is of a particular kind, care should be taken that none of the scrap metal has been previously remelted. In some cases it is necessary to remelt alloys several times, in order to secure homogeneity; but when once that result has been obtained, further remelting will only tend to destroy the properties of the solder. In a future number we will give a few details of the process known as autogenous soldering, or, in shop parlance, burning, which, in certain cases gives a superior appearance to that obtained by soldering, and, under special circumstances, is the only suitable method of uniting metallic surfaces.—*English Mechanic.*

Magnetic Railway Rails.

M. Heyl, engineer of one of the German railways, in a recent report upon the special section under his charge, calls attention, to the development of magnetism in the rails. He says: "I have observed that all the rails are transformed at their extremities, after they have been placed in position a few days, into powerful magnets, capable of attracting and of retaining a key or even a heavier piece of metallic iron. These rails preserve their magnetism even after they have been removed, but they lose it gradually. When in position, however, the magnetism is latent, only becoming free when the chairs are removed and disappearing again when they are replaced. Hence it is necessary to assume that two opposite poles come together at each junction, and that each rail is a magnet, the poles being alternately reversed throughout the line. This production of magnetism in the rails examined is undoubtedly attributable to the running of the trains, and to the shocks, friction, etc., thereby produced. The hypothesis of electric currents, induced or direct, must be rejected, since it is negatived by experiments upon the subject made with suitable apparatus. Although the interest attaching to the fact above stated is at present purely scientific, it is not impossible, says the *Franklin Journal*, that the magnetism thus developed may exercise an influence actually beneficial upon the stability of the roadway, increasing the adherence to the rails and the friction. It is possible, also, that the magnetic currents may be stronger at the moment of the passage of the trains, than either before or after. If this be so, the observations may acquire a still higher practical importance.

Pneumatic Tubes in London.

In addition to one line of 4½ feet pneumatic tubes for the transmission of large packages, mail bags, etc., there is in London an extensive system of small tubes in operation, for the sending of telegraph messages. The small tubes are from 1½ to 2¼ inches in diameter, are under the control of the Post Office department, they are divided into some twenty sections, and their aggregate length at the present time exceeds seventeen and a half miles. The messages are enclosed in carriers which are driven through the tubes by an air exhaust or air pressure, produced by six air pumps worked by three fifty horse engines, located at the central station. Where the length of the tube does not exceed one mile, the carrier goes through in about 3 minutes; but longer tubes require much more proportionate time.

Iron pipes, as well as lead, have been tried; but the result of experience is greatly in favor of lead. No deterioration is experienced in the lead pipes, and they are easy to maintain. With the iron pipes, however, the case is different; oxidation of the iron takes place, and, the interior becoming rough, the carriers are rapidly destroyed. The maintenance of an iron pipe is therefore found to be very expensive.

Provided due care is exercised in the construction of the work, interruptions of the service are of very rare occurrence. When the carriers occasionally stick fast in the pipes and cannot be moved either by compressing or exhausting the air, it is necessary to flood the pipe with water, and so force the carrier past the obstruction by an increased pressure.

All tubes are now fitted with a small pipe, by which water may be admitted if necessary.

The lead tubes are manufactured in as long lengths as possible, the 2¼ inch tubes being in lengths of about 29 feet.

Each length is laid in a wooden trough as soon as manufactured, so that it may be handled without fear of bending.

A tightly fitting polished steel "mandril," attached to a strong chain, is then drawn through the entire length of the pipe. This operation insures the pipe being smooth, cylindrical, and uniform throughout. It is necessary that the mandril should be lubricated with soft soap, so that it may not injure the pipe in passing through it.

When laid, the leaden tubes are protected by being inclosed in ordinary cast iron pipes, so that the sinking of the ground, etc., may not injure them

The process of laying and jointing the tubes is as follows:

The leaden tubes, drawn and smoothed as already explained, are delivered from the wooden troughs to the trench prepared to receive them.

The iron pipes are then drawn over the lead, leaving enough of the leaden pipe projecting to enable a "plumber's joint" to be made.

A strong chain is then passed through the length of tube to be joined on, and a polished iron mandril, similar to the one before mentioned, being heated and attached to this chain, is pushed half its length into the end of the pipe.

The new length of tube is then forced over the projecting end of the mandril, and the leaden tubes (the ends of which have been already cut flat by an apparatus made for the purpose) then butt perfectly together, and a plumber's joint is made in the usual manner. By this means the tube is perfectly airtight; and the mandril keeps the surface of the tube under the joint as smooth as at any other part of its length.

After the soldering process has been completed, the mandril is drawn out by the chain attached to it; the next length is drawn on, and the process repeated.

Where it is necessary to deviate from the straight line it is essential that the tubes be laid in a circular arc, whose radius shall not be less than 12 feet. The same care is necessary in entering the various stations, otherwise undue friction will arise, and curves would be introduced which might cause the carrier to stick fast

Snail Culture in France.

Frogs, horses, and snails—the first are an odd but toothsome dainty, which epicures, in this country as well as elsewhere, dearly prize; but horses, and especially snails—these are articles of diet which the enlightened American republic has yet to be educated to relish. Hippophagy, we have repeatedly explained, is as common in Paris, or nearly so, as the eating of beef; and the worn-out steed finds his way to the abattoir as readily as the milkless cow or stall fed ox. Hence, as a mere *bonne bouche* he has palled on the Gallic taste, educated by swollen geese livers or decayed salmon roes; a new dainty has been sought for, found, and the basis of the new industry which the production has developed is snails. There is nothing peculiar about the mollusc. It is the every-day slimy little object of which one finds thousands in gardens, vineyards, and woods. Switzerland and the provinces of Burgundy and Provence are the places of its cultivation. Throngs of women and children scour the country, collecting the snails in immense numbers, and depositing them in little tracts of land, enclosed with simply a trail of sawdust. This last the snail despises; he cannot cross it, and avoids its vicinity as a matter of preference. Therefore, for his confinement it is as good as a stone wall. After incarceration for two or three days, he is permitted to starve, and then the plot is laid out in patches of turf intersected by paths of sand. Above boards are hung to serve as shelter for the snails, which instinctively gather in large groups. The food provided consists in aromatic plants, such as mint, or lettuce and fragments of vegetables. This is fed to them three times a day in enormous quantities. At the end of eight days, the snails become quite obese, and besides have attained a very succulent flavor. Then comes another period of starvation for several days, after which transmission to market follows.

Gourmands, it is said, prefer the snail when taken wild, so long as the capture is made at a particular period. After the eggs are laid in May, the molluscs conceal themselves under stones to avoid the autumn frosts. There they become perfectly free from excretions, and, drawing themselves into their shells, close up for the winter. It is when they are collected in this state that their flavor is said to be best.

Waste of Stock.

We quote the following from our excellent cotemporary *The Carriage Monthly*; it contains, not only good advice to carriage manufacturers, but hints equally applicable to nearly all branches of trade:

In all manufacturing operations there is a liability of waste to a greater or less extent, and the profits of business are increased or diminished with the care and judgment exercised in the use of the materials employed in the articles manufactured. It is the same whether the article which we consume is high or low priced. To the carriage manufacturer this item of waste is a serious thing, calling for the greatest scrutiny upon his part. He has four departments to look after, a practical man to only one; if he be a smith or a painter, he can see where to save in his branch much better than in the branches he is not familiar with, and he has, therefore, to trust to his employee, or foreman of the department. Where is the greatest waste, may be asked: is it in the wood shop, paint shop, or trimming shop? The waste may be larger in quantity in the first named, as in this department much waste arises from want either of skill or care, or both, in selecting planks or panels, from which to cut pieces for a given purpose. The lumber itself may not be in such a shape as to cut to advantage, or in such position that a proper selection cannot be made without great waste of time. Pieces left after cutting from a board or plank, which are not wanted at that time, are thrown to one side or in the waste corner, to be cut up for firewood; and when small pieces are wanted for a given purpose, a whole plank or board is cut into, and thereby possibly spoiled for larger work to which it was adapted. The person who has the marking out of the wood work should have a place for small pieces, so that, when required, they can be easily procured without waste of time. Small savings help to make large profits. In the smith department, a great saving can be made, as in coal: using care, in cleaning off the forge, to select all the good coal from the cinders. In separating the scraps of iron, keep each class of iron scrap by itself. The care of loose screws, bolts, nuts, rivets, washers, etc., (which, in a factory running a half dozen fires, would, in the course of a year, make a very startling amount) greatly adds to the profits.

We come now to the paint shop, where the materials are very expensive and deteriorate very fast. In this department is to be found the greatest waste; the employee seems to give no thought that every ounce of paint wasted is so much money out of his employer's pocket. How often is the most expensive paint thrown away? A spoke, or we may say a wheel, has been repaired and painted over, and is to be striped with a carmine stripe; color is mixed up, which, in quantity, is sufficient to stripe a dozen wheels; when the wheel is striped, the color is laid on the shelf or bench, where it soon becomes dry and unfit for use, and it finds its place in the slush tub. Did you ever take a thought as to how many dollars that slush tub costs you? It is a mixture of all kinds of paints, from the expensive carmine to the cheapest venetian red; also, there is varnish of every grade, japan, oil, turpentine, and *time*. Can you form an estimate of its cost? I trow not; if you could, it would startle you; you would not believe that hundreds of dollars are wasted yearly in this tub. We now stop and look at the trimming shop, for there is waste here as well as in the other departments. We see cloth piled up on the shelves, varying in price, and leather of all kinds necessary. You may say there is no waste here; look under the bench; we see pieces of top and dash leather thrown together, pieces of cloth thrown in any place except the bench. These pieces can often be used up to advantage. P. Aste, in his articles on buggy tops, tells us where to put our pieces of enameled leather; other pieces can be used for curtain straps; and of what cannot be used in the shop, part can find a ready sale to the manufacturers of infants' and children's shoes, and the other can be used by the manufacturers of Prussian blue.

These facts are worthy of the thoughts of the manufacturer, and the foreman of each department. Look well to the small pieces, for they are like the small opening in the hour glass; but a grain of sand passes at a time, yet it is but a short time ere the last grain has passed through. We may not notice the small drippings from a barrel; yet if allowed to drip, it will soon be empty. It is not what we waste today, but what we waste every day that absorbs our vitals.

New Microscopic Telescope.

Mr. C. B. Boyle recently exhibited before the photographic section of the American Institute, in this city, a new optical instrument, which he called the microscopic telescope. It consisted of two parallel telescopes, about three feet in length and two inches in aperture, connected with hinges at the ends, and separated to the distance of the eyes by an adjusting screw. In order to produce the effect of the microscope, he places, before the object glass, prismatic lenses of about three feet focus, so that, when these lenses are in position, an object three feet in front of the object glass will be seen with both eyes distinctly, and magnified according to the power of the eye piece.

CURIOUS FACTS ABOUT SPONGES.

With this instrument, although but lately completed, he has already made one curious discovery—that no matter how long a sponge may have been used, no matter how long it may have been kept dry, its life is apparently restored when it is wet. The sponge being wet with warm water and placed in a warm room, the extremities of the sponge, after a little while, appear to be alive, and reach out like so many snakes. The longer they are, the greater the motion. He had observed that wetting the sponge with salt water seemed to increase the motion. Nearly half of all the slender points seemed to come to life, but after they become dry the motion ceases.

He has put upon a sponge all sorts of dust, so that they should be under the same circumstances as the pores of the sponge, but nothing but the pores of the sponge appeared to be in motion. Under the instrument, the sponge has no longer the appearance of a sponge; it appears like caverns, rocks, etc. These moving parts, when caught with pliers, would pull out a portion of the sponge. When there is much water in the sponge, they seem to be satisfied, but it is as the sponge is drying gradually that they appear to have life.

The power of this instrument was forty-two diameters.

IMMENSE PHOTOGRAPHS.—There are now on exhibition in Paris says the *Revue Industrielle*, the two largest photographs which have been made since the introduction of the art. One of these photographs represents the principal façade of the new Opera, the other one of the bronzes—the Departure, by Rude—of the Arc de Triomphe de l'Etoile. Each of the prints measures four feet three inches in length and three feet four inches in hight. They were obtained in one single piece, by well known processes, and with the aid of a large and specially constructed camera.

DECISIONS OF THE PATENT OFFICE.

BEFORE THE BOARD OF EXAMINERS-IN-CHIEF. PRESENT: MARCUS S. HOPKINS, R. L. B. CLARKE, CONCURRING.—APPLICATION OF MILLER T. GREENLEAF AND GEORGE Q. ADAMS FOR A PATENT FOR A CAR COUPLING.

In this case the Examiner admits that the patents of England and Thompson do not present the structure claimed. They do not show the transverse link stop, and are, therefore, not in point. The fire escaped cases of Jones and Mallory, however, completely answer the claim presented, and in the case of Mallory this is admitted by the applicant in argument. But the point is made that a rejected and abandoned application is not sufficient in law for the defeat or the denial of a patent. This is a legitimate point to make, and the issue it raises is not to be avoided by this Office.

The Supreme Court of the United States, in the case of Brown *vs.* Selby (O. G., Vol. 6, No. 12) held that "the mere fact of having unsuccessfully applied for a patent" could not take a case out of the category of unsuccessful experiments. This was a case in which a rejected application was invoked to defeat a patent. It had been rejected, withdrawn, and never renewed. After discussing evidence introduced with respect to the making and using of a machine by the rejected applicant, which machine was held to have been an experimental one, the court said: "Were it not for the application for a patent, it (the machine) would justly be regarded as an abandoned experiment. Can the fact that such an application was made, and afterwards voluntarily withdrawn, make any difference? We think not." Thus it appears the Supreme Court gave no weight whatever to a mere rejected and abandoned application, in the absence of independent proof sufficient to defeat the patent in question. The force of the application as proof of prior invention was one of the issues before them, and they decided it definitely.

In the case of the Northwestern Fire Extinguisher Company *vs.* the Philadelphia Fire Extinguisher Company (O. G. Vol. 6, No. 2), a rejected application which had not been withdrawn or formally abandoned, but which was probably an abandoned application by operation of the 32d and 35th sections of the Act of July 8, 1870, was invoked to defeat a patent, or one of the claims of a patent. The court gave the subject elaborate and learned consideration, and distinctly held the application, of itself, although accompanied by model and drawing, not to be effective proof of prior invention. But proof having been offered, and complete working apparatus having been exhibited to show, that the invention was actually perfected and used in public at the time of, or prior to, the filing of the rejected application, that application and the drawings with it were admitted as evidence tending to explain the invention, and strengthen the other evidence of the fact of the real making of the invention.

The language of the court was that rejected applications "lack the essential quality of a publication, in that they were not designed for general circulation, nor were they made accessible to the public generally. They were placed in the custody of the Commissioner of Patents, not that they might thereby become known to the public, but for the special purpose of being examined and passed upon by him.

"Although they might incidentally become known to any one whose researches in the Patent Office might disclose their existence, they are not, therefore, published within the meaning of the act of Congress.

"But it is said they establish the fact of invention, and so disprove the novelty of an invention subsequent in date. It is needless to refer to authorities to show what is so well settled, that a written description of a machine, although illustrated by drawings, which has not been given to the public, does not constitute an invention within the meaning of the patent laws. It may be so full and precise as to enable any one skilled in the art to which it appertains to construct the machine described; but until it has been embodied in a form capable of useful operation, it has not attained the proportions or the character of a complete invention. However suggestive and valuable it may be as an untried theory, it is ineffective against the practical and useful product of inventive skill."

In the case of the Lyman Ventilating and Refrigerator Company *vs.* Taylor (O. G. Vol. 6, No. 2), the above decision was cited with approval, and the court held that an alleged invention, as exhibited in a rejected application merely, must be laid out of view as an objection to the validity of a patent.

The court said: "As regards anything shown in the original application of Fairbanks, made in 1846 and rejected and withdrawn in 1847, it is well settled that a written description of a machine, although illustrated by drawings, which has not been given to the public, does not constitute an invention within the meaning of the patent laws. Evidence that such a description was made does not show of itself a prior invention. Such a description has not the same effect as a printed publication. It lacks the essential quality of such publication; for even though deposited in the Patent Office, it is not designed for general circulation, nor is it made accessible to the public generally, being so deposited for the special purpose of being examined and passed upon by the Patent Office, and not that it may thereby become known to the public. Although it may incidentally become known, the deposit of it is not a publication of it, within the meaning of the statute or the law. Moreover, although the description may be so full and precise as to enable any one skilled in the art to which it appertains to construct what it describes, it does not attain the proportions or the character of a complete invention until it is embodied in a form capable of useful operation."

The same was also held in different jurisdictions, with respect to the same subject matter, in the cases of Lyman *vs.* Myers, and the Lyman Patent R. Co. *vs.* Oswald. It is clear, we think, that a rejected application is not a publication. It does not necessarily make an invention known to the public, and cannot by presumption of law be assumed to do it. If through it, as through any other medium, an invention has actually been made known to the public, proof of that fact would bar the grant or destroy the validity of a patent. But it would be the proof, and not the rejected application, as such, that would have that effect; for such an application is not proof of either reduction of an invention to practice, or of its public use. Without proof of the making and using of what it may describe and illustrate, it is clear, we think, in the light of the above mentioned decisions, and of a sound interpretation of the statute, that a rejected and abandoned application is not sufficient to defeat a patent; and we see no sound reason why it should be held sufficient to warrant the denial of a patent. The abandonment of an application by operation of the present statute, or otherwise, we think, by no means necessarily works the abandonment of the alleged invention it purports to describe. For it necessarily follows that, if a rejected and abandoned application is not sufficient, in the absence of any other evidence, to establish the making of an invention, it cannot be sufficient to establish the abandonment of an invention; because an invention cannot be shown to have been abandoned until it is first shown to have been made. In fact, the court decisions above cited go directly to this point. Some of the abandoned applications invoked in those suits were abandoned by the voluntary acts of the parties, and some, it would appear, by the operation of the act of 1870. Now if the abandonment of these applications worked the abandonment of the alleged inventions they purported to describe, the courts must have held the patents before them invalid, on the ground that the inventions had been abandoned to the public and become common property. They did not so hold, and we are left no other conclusion, either from the decisions referred to or from the language of the law, than that the abandonment of an application is but the loss of the applicant's remedy by that particular proceeding, with costs, and nothing more. A consideration of what an application is would seem to make this clear.

When an alleged inventor duly files an application for a patent in this Office, he thereby institutes a legal proceeding for the purpose of securing an alleged right. It is essentially an action *in rem*. The abandonment of the application is merely the abandonment of that proceeding—the abandonment of his attempt by due process of law to make his alleged inventions patent. It is the same as if he had sustained a nonsuit in a trial at law. Another proceeding may be instituted, that is, another application may be filed; and unless there be proof (aside from the abandonment of a former application) that the invention in itself has been abandoned, we presume a patent would have to issue. Were the mere abandonment of the application to work the abandonment of the invention to the public, this consequence might follow. If an inventor made an assignment of his invention or of an interest in it, before application for a patent, or before a patent had been obtained, as frequently happens, the title to the invention, or part of it, would be in the assignee; yet, if the inventor failed to complete his application, or neglected to prosecute it, and it became abandoned, the assignee would thus be deprived of his interest in the invention; for the invention cannot go to the public and still the title to it subsist in an assignee. The statute specifies the abandonment of the "application" *only*, as a consequence of delay to prosecute it, and it would be strange if that consequence were also, by presumption of law, to include the invention. An inventor should not be held to be in a worse position by merely having attempted to make an invention patent, than if he had never made such an attempt. There is ample scope for a remedial and beneficial operation of the statute without such a construction of it. For instance, before the act of 1870, if an application for patent was filed, it might be delayed in its prosecution for years, and finally go to patent, and the patent would be valid, even if, pending the application, the invention had gone into general use by the public. (Jones *vs.* Sewal, O. G. Vol. 3, p. 638, and cases there cited.) The fact that the applicant continued his claim in the Office was sufficient to save his rights, unless it could be proved that by some act of his own he voluntarily relinquished them to the public. But under the act of 1870, providing for the abandonment of an "application" by mere delay to prosecute it, more than two years' public use of an invention *after* an application has been filed and not duly prosecuted, may evidently work abandonment of the invention, as well as *beofre* filing an application. The reason is that, when an application has been rejected and abandoned, the thing it may describe and illustrate is in substantially the same condition as if no application for patent for it had ever been filed. The application has become a nullity, and the section of the statute providing for the abandonment of an "invention," by public use of it *before* application has been made for patent upon it, will begin to operate just as if there had not been an application filed. Thus by the present law inventors are spurred to diligence in making their inventions patent (which the law favors), not only by a liability to forfeit the benefit of their applications, but also by a liability to forfeit their inventions, through public use, after their applications have been filed and become void.

But the evils, if there really be any, which may follow a radical change in the adjudications of the Office, with respect to the holding of rejected and abandoned applications a bar to the grant of patents for the devices they may describe and illustrate, must not be left out of view in this connection. There are thousands of these applications now in the Office. It is probable that most of them have been legally rejected, and that the references upon which they were rejected might now be cited as a sufficient answer to new claims made for the devices they comprehend. But it may be that some of them have been improperly rejected. It is only such of them as have been that need be considered; for within the files of all the others will be found a citation of legal references to anticipate, which references may be used again to answer all subsequent applications for the same things. But it may be suggested that the models or drawings of rejected applications in this Office are accessible to the public, that they may be inspected, and that the persons may thereby obtain suggestions of the inventions they illustrate, and procure patents fraudulently. If, however, the fact in any case appear that an applicant is not an *original* inventor, that is good ground for refusing him a patent. If it does not appear, fraud cannot be presumed against him. He must swear that he is the *original* inventor before he can have a patent, and that is all the precaution the law at present institutes. An anticipation of possible fraud will not justify a refusal to allow inventions to be made patent that have never yet been made so, or otherwise fully communicated to the knowledge of the public. The fact that the public may learn of them through the accident of their display here (for there is no law requiring them to be displayed, and whether they ever are or not depends upon the will of the Commissioner) is no sufficient reason to deny patents, in the absence of proof that the alleged inventions have gone into public use and become common property. When this fact is ascertained in the Office, a patent will not be allowed, and where it is judicially ascertained out of the Office, after a patent has issued, the courts will declare the patent void. We apprehend, therefore, that no harm can come to the public from making patent things which, so far as this Office can duly ascertain, have merely been wrongly withheld from patent. Such things the good of the public demands should be made patent, and the more of them there are the stronger is the demand. Making them patent is the means provided by law "to promote the progress of the useful arts." So far as applicants themselves are concerned, he only who prosecutes his rights in the manner marked out by law will get them lawfully *secured*, is entitled to any consideration. He who duly makes the invention patent to the public is entitled to reward, and he who *falls* from neglect is not. The law, we repeat, always favors the making of all new and useful inventions patent, and an invention is new, in contemplation of law, until it has been made patent, or described in a printed publication, or completely embodied in operative form and conferred upon the public, in this country.

We have then this case to meet. Supposing it to have been ascertained, to the satisfaction of the Office, that an abandoned application was unlawfully refused to be admitted to patent, we must refuse a present application permission to make the alleged invention patent, merely because of a wrongful and unlawful refusal of a former application that has become void, or else we must now permit the alleged invention to be made patent as the law contemplates. Can there be any doubt as to which is the proper course? The former application is now but a mere unpublished description and illustration of the invention. As we have already seen, it is not evidence of the perfection of an invention such as the law acknowledges. Until it has reached the perfected state of an actual grant, or patent, the benefit, for which a temporary monopoly is allowed by law, has not been conferred upon the public by the applicant. Until that time, a rejected and abandoned application stands in the same category, so far as the legal effect to bar a patent is concerned, with an unperfected experimental machine. It exhibits, in contemplation of law, merely an inchoate invention, not made public. Like an expired caveat, it is an imperfect manifestation of an embryonic device, and, like an expired caveat, it should never be invoked to obstruct the promulgation of a perfected invention.

But if any real evil is imminent, from the discontinuance of answering applications for patents in this Office by other unanswerable applications, then it can no doubt be easily avoided when it actually arrives. An act of Congress providing for the publication of rejected applications, or declaring the display of rejected models here for a limited time equivalent to publication, would be effectual. We see no reason for our continuing an unlawful course from any apprehension of evil to come from a lawful one.

These are our opinions, and we are urged here, with much apparent force of reason, to pass our judgment upon this case without regard to what has heretofore been done in the Office in like cases. We must consider whether we ought to or not; and we have held this case under advisement for some time, in order, if possible, to correctly ascertain our legal obligation in the premises. It is true, no doubt, as maintained in argument, that the whole country, including the tribunals in the Patent Office, must follow the law, as uniformly constructed and applied by the United States Courts. It is also true, so far as we are aware, that there have been no recent decisions of the Commissioner (made since the foregoing court decisions were announced) that require us to hold that a rejected and abandoned application is sufficient in law to defeat an application for a patent. Yet for a long time it has been customary in the Office to reject applications for patents, upon reference to rejected and abandoned applications; and we must consider whether it is expedient, and our official duty, in advance of any action by the Commissioner upon the subject, to undertake to change this course for ourselves, even though we hold to the opinion that a change is now necessary to bring our action into conformity with the law, as of late judicially interpreted and declared. There is not the slightest conflict, of which we are aware, under the present law, between the board and the Commissioner as to our jurisdiction; but as the subject has not been judicially passed upon, and as the point is involved, it is proper for us to now consider it.

(To be concluded in a future issue.)

Recent American and Foreign Patents.

Improved Fastening for Railroad Rails.

John L. Stewart, Ellicott city, Md.—The object of this invention is to provide a fastening for railroad rails, in which the use of the ordinary spikes is dispensed with, and the devices so constructed that, the greater the pressure upon the rails, the tighter they are clamped. It consists in a grooved base plate attached to the ties and containing sliding boxes, which boxes are held in place by keys engaging with undercut ledges in the said base plate. The said boxes contain pivoted hooks having a horizontal groove in the lower part, in which rests a bearing plate which supports the rail. Beneath said bearing plate is a cushion of rubber, so arranged that, when compressed by the bearing plate from the weight of the train on the rail, the hooks are made to clamp the rail more tightly.

Improved Machine for Making Fence Pickets.

Isaac Levy, Ellaville, Fla.—The invention is an improvement in the class of machines wherein revolving and vertically adjustable cutter heads are employed for dressing the heads of the pickets. The improvement relates particularly to the construction of the sliding or reciprocating table and an attachment thereof, for supporting and clamping pickets of different lengths.

Improved Door Mat.

Orrin Rice, Adrian, Ill.—The sheet metal plate is perforated with holes, and the tufts of corn husks are inserted through them, one end of each tuft being drawn through one of a pair of holes, and the other end through the contiguous hole, so that the free end portions of the tuft will project on the opposite or face side of the plate, and the middle portion will project on the back of the plate. The ends of the several tufts are then cut to a uniform length, and the mat is complete.

Improved Cherry Pitter.

William B. Knapp, Tecumseh, Mich., assignor to himself and Frank Bumann, of same place.—This cherry pitter is formed of a tube, open at both ends, having a knob placed at one end, and teeth formed upon its other end. The cherry is pressed against the toothed end of the tube, which causes the pit to drop through the tube into a receiver, leaving the cherry whole and ready for use.

Improved Handle for Child's Carriage.

Charles F. Lauer, Pittsburgh, Pa.—This is a metal handle for children's carriages, having a concave T-shaped piece for attaching it to the wood frame by which the carriage is propelled. The T piece is so contrived that it applies to the cross piece and one of the shafts at their junction, and also serves to re-enforce and strengthen them, besides attaching the handle, thus uniting two pieces in one, and saving labor and material in the making.

Improved Atomizer.

Charles E. Robinson, Brooklyn, N. Y.—This invention relates to certain improvements in burners or atomizers for oil-burning furnaces. It consists in the combination of a tubular valve, a stem valve contained inside the tubular valve, and a valve seat, so constructed and arranged that the jets of steam and combustible liquid issuing therefrom form two hollow cones intersecting and inverted with respect to each other, so as to insure the thorough mixture of the two elements. The invention further consists in the combination with the said valves and valve stems of their respective feed pipes, and also in the adjustment of the valves.

Improved Oil-Burning Apparatus.

Charles E. Robinson, Brooklyn, N. Y.—The object of this invention is to provide a means for supplying petroleum or other liquid hydrocarbon to oil-burning furnaces. It consists in a large supply tank provided with a steam heating coil, a feed pipe extending below the surface of the oil, and a pipe for admitting direct steam pressure upon the oil for forcing it out, in combination with an oil reservoir communicating therewith by means of a valve, and provided with a level gage and inlet pipes for the oil and steam.

Improved Book of Letter Sheets.

Henry S. Jackson, New York city.—The object of this invention is to provide convenient means for leaving memorandum in the absence of persons called upon, and for preventing trouble and delay in writing notes on various occasions; and it consists in a book having the leaves gummed for sealing, with perforations across the leaves to allow each leaf to be easily torn off.

Improved Lamp Burner.

James Curzon, Darien, Conn.—This is a burner of two wicks, having the wick tubes bent longitudinally, either their upper parts or throughout their entire length, and so arranged as to form a star or similar shaped light.

Improved Bed Pipes for Lead-Corroding Houses

Peter H. Decker, Morsston, N. Y.—This invention has for its object to furnish ventilating or bed pipes for causing a uniform circulation and the same degree of heat through all the corroding pots of all the tiers of the stack. The invention consists in pipes made tapering and provided with blocks in the interior of their lower parts, with holes in the lower and upper parts of their sides, and with caps at their upper ends. By this construction the passage of the vapors from the lower to the upper pipes induces a draft from each tier of pots.

Improved Fire Box Attachment to Steam Boilers.

John Lee, Hazleton, Pa.—The object is to protect the rivet joint from the direct impingement of heat, so as to avoid the weakening of the seam joint without diminishing the fire surface. This is done by a seamless hollow casting, having projecting tubes which may be forced through and held tightly in holes of the boiler, while they may be readily removed by driving a punch passed through the outer holes. The latter may be stopped by detachable plugs.

Improved Thread-Winding Guide.

Eugene L. Manchester and John A. Bolen, Springfield, Mass.—This relates to the thread-winding guide used in thread mills for guiding the thread and laying it on the spools. It consists of a wheel in that part of the guide which is employed for laying and compacting the thread on the spool. The object is to substitute rolling for sliding friction, and thereby economize in the cost of guides by largely lessening the wear.

Improved Ruffler.

James McCullough, Aspinwall, Neb.—The essential feature of this invention consists of the ruffling pawl or plate, mounted so as to work on a pivot, and connected to the bell crank, by which it is worked in such manner that the friction due to sliding in ways is avoided. It is so actuated that, in pushing the cloth forward, it presses harder as the resistance increases, and in drawing back it rises off the cloth and moves back easily; and it also acts as a guide to control the cloth and prevent the ruffle from working laterally out of the ruffler.

Improved Self-Closing Hatchway.

Samuel Lawrence, New York city.—The covers of the several floors are connected. To the upper covers are attached cords which are secured to counterpoised levers. This construction throws the levers back when the covers are raised, so that they will be out of the way of the carriage. To the inner ends of the levers are attached cords, which join a single cord which passes down along the side of the hoisting rope, and its lower end is attached to the carriage. To the cord, at suitable distances apart, are attached rings, through which the hoisting rope passes, so that, when the carriage is raised, the cord may gather in loops. By this construction, as the carriage is raised, the weights raise the covers, so that the carriage does not come in contact with said covers. As the carriage in its descent approaches the bottom of the well hole, its weight tightens the cords, draws down the levers, and raises the weights, allowing the covers to close gradually by their own weight.

Improved Bottle Stopper.

Charles De Quillfeldt, New York city.—A stopper-carrying yoke is pivoted at some distance from the ends of a wire lever frame, swinging in eyes of a wire band attached to the neck of the bottle. The elastic stopper is made with disk-shaped base and cylindrical shank, perforated for the passage of the yoke, and is tightly secured to the bottle by a sleeve-shaped and flanged cap piece. The closing of the stopper is performed by guiding the base part into position on the mouth, and swinging the lower frame down.

Improved Sewing Machine Caster.

John H. Plank, Bloomfield, Iowa.—This invention consists in combining a lever with the socket plates which receive the feet of the sewing machine legs. Said lever is pivoted and otherwise so arranged that, by a movement thereof, the casters of one end of the socket may be lifted off the floor and the support of the machine transferred to the legs, to hold the machine firmly against shifting about while being used.

Notes & Queries

L. D. will find a recipe for polishing furniture on p. 11, vol. 31.—C. T. R. will find directions for coating iron with black enamel on p. 208, vol. 26.—W. H. and O. R. should consult a physician.—D. can utilise the tin on tinned plate scrap by the process described on p. 319, vol. 31.—A. M. C. can temper gun springs by the method detailed on p. 10, vol. 25.—C. P. McE. will find a recipe for japanning on tin on p. 75, vol. 32.—W. D. G. will find a recipe for bronze on iron on p. 283, vol. 31.—C. H. S. can whiten ivory by the process detailed on p. 10, vol. 32. The theory of power by the crank is explained on p. 112, vol. 31.—W. S. will find an explanation of two lines approaching each other and never meeting on p. 138, vol. 31.—H. W. M. can make composition molds by following the directions on p. 58, vol. 24. Cement for cracks in cast iron is described on p. 409, vol. 31.—B. will find a description of the manufacture of sulphurous acid on p. 111, vol. 29.—B. McD. will find a recipe for indelible ink on p. 129, vol. 28.—F. J. H. will find directions for stuffing animals on p. 350, vol. 30.—W. H. will find directions for silvering glass by Draper's process on p. 267, vol. 31.—C. A. G. will find an explanation of sailing faster than the wind on p. 132, vol. 29.—J. C. C. will find directions for putting a black finish on gun work on p. 208, vol. 26.—C. E. D. G. will find a description of a gaslight machine on p. 379, vol. 30.—W. N. H. will find a recipe for a cement for rubber on p. 203, vol. 30.—W. H. S. will find a formula for a red indelible ink on p. 129, vol. 28, and for a black, on p. 112, vol. 27.—Q. R. N. will find directions for etching on glass on p. 409, vol. 31.—J. H. will find directions for bronzing cast iron on p. 283, vol. 41.

(1) O. S. asks: Will sawdust, placed under a printing press or other machinery, absorb the waste oil, produce combustion? A. There will be some danger of such a result; but the occurrence is not very frequent, and can be prevented by ordinary care.

(2) J. W. W. asks: Does the hydraulic or water ram waste more water with a fall of three or four feet than it will elevate to a hight of 12 feet? A. Generally, yes.

1. Can the blaze from a kerosene, alcohol, or common oil lamp exist in a receiver of compressed air of 30 lbs. per square inch, the air escaping and fresh air being supplied all the time? A. Yes. 2. How much will air expand by heating? A. About $\frac{1}{492}$ of its volume at 32° Fah. for each degree Fah. that its temperature is increased.

(3) C. asks: 1. Which is the right name for the coal that is called sometimes candle coal and sometimes canal coal? A. The coal was originally called candle coal, and cannel coal and canal coal are corruptions of this name. The term cannel has obtained such general currency that it would be thought singular to speak of candle coal, and yet that this is the proper name is evident from the fact that it was first so called because the coal burnt with a clear, long, yellow flame, like a candle. It is a very compact coal, with an even texture and a smooth, clean, and nearly dull surface and conchoidal fracture. The dull luster gives it the aspect often of being impure, when not so. The proportion of bitumen is large, as may be seen from the following analyses: The cannel coal of Boghead, Scotland, has 66 per cent bituminous matters, 31 per cent fixed carbon, and 3 per cent ash. That of Breckenridge, Ky., has from 56 to 72 per cent bituminous matters, 28 to 44 per cent fixed carbon, and 7 to 12 per cent ash. Ultimate analyses, to determine the proportion of the elements, the ashes excluded, have given, for the Boghead cannel coal, carbon 80·49 per cent, hydrogen 11·24 per cent, oxygen 6·73 per cent, nitrogen 0·87 per cent; for the Breckenridge, carbon 82·36, hydrogen 7·84, oxygen 7·05, and nitrogen 2·75 per cent.

(4) R. H. H. says: I am building a jig saw to run by foot power. Can I use a cylinder with a piston and piston head above the saw to lift it, using air for a spring in the cylinder? I want to run the saw at 600 1½ inch strokes per minute. A. You can run it in the way you propose. It is doubtful whether you will be able to attain that speed by force applied to a treadle. We shall be glad to hear from you again when you have completed the machine.

(5) E. M. asks: 1. How many pounds of steam will it take to make one horse power? A. It varies from 15 to 200, according to the kind of engine. 2. Would thick glass be strong enough to make a small steam cylinder, to see how it operates? A. Yes.

(6) B. H. R. asks: Is there any difficulty in putting a circular one horse power upon the ground, and running into a second story to turn a printing press? A. Ordinarily, no.

(7) W. F. S. says: I use steam heating and water pipes. My boiler has not been running or had a fire under it for some two or three weeks, and the shop has had no fire in it for several days of severe cold weather. The water in the pipes was frozen, but did not burst a pipe or start a leak anywhere until I had steam around the shop long enough to materially affect the temperature. Why should the pipes not burst till the room became warm? I supposed that 1 square inch of water, if it were frozen, would require considerably more room. Is this so? A. This is a very common occurrence. There is often air in the pipe, that allows the water to expand in freezing. When heat is applied, however, some of the ice melts, and the water, expanding rapidly as its temperature is raised, encounters resistance from the ice, and so bursts the pipe. More frequently, however, the pipes do burst during the cold weather, and are held together, or prevented from leaking, by the ice that is formed. When the latter melts, however, the leaks are at once disclosed.

(8) J. H. W. asks: 1. What is your opinion in regard to blast pipes under boiler furnaces? Do they materially affect the burning out of the boilers? A. No. 2. Would their use result in a saving of fuel? A. Generally, no; except that, by the use of the blast, an inferior quality of coal can often be employed.

(9) W. H. asks: How can I remove dirt and grease from my hands without injuring the flesh? A. Oil answers in many cases, supplemented by a vigorous application of soap and water, and, in some cases, sand or corn meal; but there are doubtless peculiarities of flesh that render it impossible to give a method which is generally applicable. We do not doubt, however, that we have many readers who can furnish valuable information on this subject, and we hope to hear from them.

(10) J. W. F. says: I am thinking of building a boat 63 feet long with 15 feet beam, to draw from 5 feet light to 6½ feet loaded. I was thinking of putting in an engine 18 inches diameter by 15 inches stroke, with a screw of 66 inches diameter and 11 feet pitch. Boiler (locomotive) is to be 4 feet 6 inches diameter, with a fire box 4 feet 4 inches by 3 feet 10 inches, with 55 tubes, 3 inches diameter and 10 feet long, using steam at 80 lbs. The boat's lines are pretty fine. What speed will this engine drive her? A. If the boiler steams well, the boat should go from 15 to 16 miles an hour. For a speed of 10 or 12 miles an hour, use an engine 12x12.

(11) T. D. says: I have a steam pump with a hole cut in the piston rod a quarter of an inch deep; the hole was cut in by the cataract. The rod is of brass. When that hole passes through the stuffing box, the steam comes out. Can you tell me what I can fill the hole up with? A. Screw in a plug, and finish off the surface.

(12) F. H. D. asks: 1. Why is it that small drive wheels are used for climbing steep grades or drawing heavy loads, and what advantage has a small wheel over a large one? A. With a small wheel the tractile force is greater, for the same pressure on the piston; but the locomotive does not move as fast for same piston speed as the one with larger driving wheels. 2. Is a wheel more liable to slip when the crank goes under the axle than when it goes over the axle. A. No.

(13) W. H. S. asks: In your reply to W. B. C. you say "the silver being extracted from the pig lead and not from the ore." By what process is this accomplished without burning the lead, as some do, since both have very nearly the same specific gravity? A. This method essentially consists in a concentration process, based upon the phenomenon that, when a certain quantity of lead that contains silver is melted in iron cauldrons, and the fluid is allowed to cool uniformly, there ensues a formation of small octahedral crystals, which are a great deal poorer in silver than the metal originally taken; while the portion of the metal remaining fluid is found to contain an increased quantity of silver. It is clear, therefore, that, if the crystals first obtained are again melted and cooled uniformly, another concentration will be obtained, and that the operation can be repeated until a lead is obtained rich enough in silver to admit of undergoing a refining process. In all cases, however, the quantity of lead operated upon is always large, generally 200 cwts., to cause the cooling to proceed slowly. 2. Is the method as practised at Swansea in Wales a secret, or is it adopted in this country? A. We are not familiar with the process you speak of.

(14) G. W. B. says: In our coal stoves, there is a hard substance adhering to the firebrick, apparently the result of impurities in the coals. What is this substance, and can it be removed by any better method than by the use of the cold chisel? A. No doubt you are right as to its being composed of impurities. By cleaning it out at short intervals, so that the quantity will not be great at a time, it can readily be removed.

(15) L. E. F. asks: What colors take best in photography? A. Blue takes very light, in some cases appearing as if, in the original object, the blue portions were really white. Yellows, reds, orange, and various shades of green take dark.

What is the best position to lie in during sleep? A. Physicians frequently recommend the left side, as the position in which the organs of the body are least liable to cause discomfort by pressure upon one another.

(16) M. T. says: The natural oil in rosewood or satinwood often renders it difficult to unite them with glue. Cannot a strong acid or alkali, being first applied to the wood or united with the glue, be made to destroy the effect of the oil and cause the wood to unite more readily? A. Try the action of a warm solution of potash, applied for a short time and carefully wiped off.

The water in my well has a singular effect on tea, causing it to turn to a wine red color shortly after steeping. It first turns in streaks or clouds of red: and before the meal is finished the beverage "giveth its color in the cup" and causes a lack of relish for it. Our pump has a cucumber wood pipe. Can you gratify our curiosity by an explanation? A. We cannot give you any satisfactory answer without having first made an examination of the water. Send us a quantity of your water and a sample of the tea, and we will endeavor to solve the problem for you.

(17) E. L. asks: What do licenses for steamboats and their engineers cost, and how long do they last? A. The license for the boat costs $25, license for engineer $5; they are renewable once a year.

(18) M. T. K. asks: How can I make petroleum and gas tar unite? A. Try dissolving the tar in the petroleum with the aid of benzole and moderate heating.

(19) H. A. S. asks: 1. At what speed should a ⅝ inch band saw on 16 inch pulleys run, using two horse power? A. It is quite common to run such saws at a speed of 5,000 feet a minute. 2. Would it be safe to run this saw on such small pulleys? A. Your pulleys are too small.

(20) A. R. asks: Is mica, as used for stove lights, found in its natural state in sheets? A. Mica is found in large crystals, made up of a great number of fine sheets. The stove mica is made by simply dividing the crystals so as to obtain the sheets of the required thickness.

(21) W. J. C. asks: 1. Will a properly constructed thermometer inserted in the steam dome of a boiler indicate whether the steam is dry? The vapor evolved from a fluid being always of the temperature of the fluid itself, so long as it remains in contact with it, I am led to doubt whether a thermometer would show any difference between steam dry and steam containing particles of water in mechanical suspension. A. The thermometer would not show any difference unless the steam were superheated. 2. If the dryness of steam cannot be thus indicated, how can it be determined? A. For a method of determining the amount of water in the steam, see p. 257, vol. 31.

(22) J. P. E. asks: 1. Can a silver plate be set in a man's skull where there is a hole broken in it? A. Yes. 2. Can a silver bridge be put in a man's broken nose? A. Yes.

(23) A. M. asks: 1. Where is ice formed, at bottom or on top of water? A. On top. 2. Will ice under any natural circumstances sink to bottom, in water? A. No.

(24) J. E. H. says: We have a double steam pump of the following dimensions: 7 inch plunger, 12 inch stroke, and 12 inch steam cylinders. It is used to pump water through a 4 inch pipe into a reservoir about 50 feet above the level of the pump. If a stopcock were put in the pipe near the reservoir, and near the stopcock a fire plug, would the pump force water through 1,000 feet of hose with sufficient force and to a sufficient hight to extinguish fires, part of our town being 100 feet above the level of the pump? A. It would probably be necessary to increase the steam pressure.

(25) C. C. W. says: 1. I understand that there is a train run from London to Liverpool, the card time of which is an average of 47 miles per hour, including stops. Is this practicable? A. It may be practicable, but we do not think that it is done. 2. I understand that an English locomotive has made the extraordinary time of 82 miles per hour, drawing 5 coaches. Is that possible? A. There is such a report, but it is not well authenticated. 3. What is the best hour's run ever made by a locomotive? A. The best of which we have knowledge was about 63 miles an hour.

(26) W. McB. asks: 1. How many cubic feet of hydrogen gas (manufactured from zinc and acid or vitriol) are required to raise a weight of 1 lb. to a hight of 10 feet? A. You must first state whether you wish to know the ascensional force of a bulk of hydrogen, sufficient to raise the weight mentioned, or the mechanical force equivalent to the heat given out in burning a certain number of cubic feet. 2. What are the proportions of zinc and acid to make gas with, and what is the best way of generating the gas? A. The zinc is used in any quantity that is convenient, and a mixture of oil of vitriol 4 parts, water 4 parts, poured upon it, in a suitable bottle provided with a cork and an exit tube.

(27) J. H. P. asks: I have air slaked lime and pure carbolic acid. How can I impregnate the lime with the acid so as to make an effective insect-repelling mixture for garden vegetables? A. This compound may be obtained by digesting your lime in the acid. It is a very unstable salt, easily decomposed.

(28) N.Y. asks: 1. Can the nerve of a tooth be killed? A. Yes. 2. How long will the tooth last after the nerve is destroyed? A. If the tooth is properly filled after the operation, it will last, in most cases, a very long time.

(29) J. McL. asks: What acid will eat zinc the quickest and bite the sharpest? A. Sulphuric acid, diluted with from 3 to 5 pints of water.

(30) L. K. D. asks: Is there anything that will make plaster harder than it is when dry after being mixed with water? A. Use a strong solution of alum instead of pure water.

(31) H. B. P. asks: How can I plate with gold, silver, and nickel upon steel and nickel silver without first using a coppering solution? A. Iron and steel must first be electroplated with copper

(32) C. W. asks: Will you please tell me how to detect impurities and adulterations in linseed oil? A. The purity of the fixed oils may be determined approximately, and the admixture of cheaper oils detected, (1) by observing the peculiar odor of the oil when gently heated by a spirit lamp in a small porcelain or platinum capsule. The odor evolved will resemble that of the plant or animal from which it is obtained. In this way linseed oil, whale oil, train oil, or rape oil may be detected even when used to adulterate another oil. (2) By mixing concentrated sulphuric acid with oil (1 or 2 parts acid to 100 oil) the temperature rises and the mixture becomes colored. If a plate of white glass be placed on a sheet of white paper, and 10 or 15 drops of oil be placed on the glass and a small drop of acid be added, a color will be produced which varies with the oil employed. With rape oil, a greenish blue ring forms at a certain distance from the acid, while towards the center light yellow brown streaks may be observed. Olive oil instantly becomes pale yellow, and afterwards yellowish green. In linseed oil, a beautiful dark brownish red web is formed, gradually changing into brownish black. Tallow oil or oleic acid becomes brown. It seldom occurs that a better oil is used to adulterate an inferior one. Oil of almonds, olive, and codfish oil will, therefore, never be used to adulterate rape oil, but probably train, or perhaps linseed, and sometimes poppy oil. If we are led, therefore, by the odor to infer an adulteration, for instance, for train oil, which occurs most frequently, it is only necessary to place from 10 to 15 drops of rape oil, the purity of which is undoubted, together with as much train oil, and an equal quantity of the oil whose purity is suspected, and add to each of them a drop of sulphuric acid. From the color produced an inference may be formed of the purity of the oil; and by the different tinges of color the extent of adulteration may be detected. (3) By the oleometer, indicating the specific gravity of oil in such a way that pure rape seed oil is indicated by 37° to 38°, hemp oil from 30° to 31°. There are various other tests; that by the capillarimeter indicates the quantity of the oil which falls from a certain sized point under given circumstances, etc.

(33) G. M. R. says: A daily journal gives the following test to be applied to quartz, to determine its auriferous character: "After being well ground and calcined, it should be treated with a bath of iodine or bromine water, and allowed to digest in it for some time. Then a piece of filter paper should be soaked in the solution, dried, and burned to ashes in a muffle. If gold is present, the ash is purple. One pennyweight of gold to the tun may thus be detected." Please give me details of the preparation of the iodine or bromine water. A. The solution of iodine or bromine is readily obtained by placing a small quantity of either iodine or bromine in a bottle with a quantity of pure water, and shaking. The color of solution, if bromine has been used, will be orange yellow. The bromine is more soluble in water than the iodine, which is very slightly soluble. Both the solutions dissolve gold, to form either iodide or bromide of gold. These are readily decomposed upon application of heat, and give the characteristic color mentioned in the test.

(34) T. H. W. asks: 1. How can I keep my zinc in a lead and zinc battery from getting covered with a black substance? A. You cannot help its turning black, except by covering it with mercury. 2. Does the substance have any effect on the strength of the battery? A. No.

(35) G. S. P. asks: How can I arrange a magneto-electric machine that is used in medical purposes so as to have a negative and a positive pole? A. One pole is negative and the other positive. You cannot have a current with both poles positive.

(36) J. E. G. asks: What size of copper wire will do to convey the same amount of electricity as the common telegraph wire? A. Copper is six times as good a conductor as iron, and therefore a copper wire one sixth as large would conduct as much electricity as the iron wire now used.

(37) W. C. C. asks: How can I construct a safe and cheap kerosene lamp for blowpipe soldering purposes? A. For this purpose a small lamp of glass is best. The top should be composed of a small brass disk (about ¾ inch in diameter) through which the wick tube passes. The disk should be supported by a metal frame, into which it fits loosely, in such a manner that, while in its normal position, it prevents the air from entering the lamp; it also acts as a safety valve, making it impossible for an explosion of any kind to occur. The lamp should be furnished with a brass cup which screws over the top, thus rendering it portable, prevents the spilling of the liquid in case the lamp is overturned, and also deters evaporation when not in use. This, we believe, is the simplest and best form of lamp for this purpose.

(38) F. asks: Does it make any difference, in an induction coil, which way the wires of the coarse helix run, in respect to the fine helix? Should the two helices be wound in the same direction, or in different directions? A. It makes no difference, which way you wind them.

(39) W. T. B. asks: How can I dissolve sulphur in water, so as to make a strong permanent solution? A. Free sulphur is insoluble in water under any condition. Many of its compounds, however, are soluble, some extremely so. The affinity existing between sulphuric acid (which is a compound of sulphur with oxygen) and water is so great that, by its absorption of the aqueous vapor from the air, when freely exposed, it soon doubles its own volume. The ordinary "sulphur water," as obtained from what are known as sulphur springs, is simply a solution in water of gaseous sulphuretted hydrogen, which, as its name denotes, is a compound of sulphur with hydrogen. This gas may be artificially obtained, cheaply and in large quantities, by the action of dilute oil of vitriol on sulphide of iron. A solution of the gas is easily obtained by passing it through water.

(40) C. A. M. asks: How should the electro-magnet of a small telegraph be constructed? A. Wind copper wire, insulated with silk, around a core of soft iron.

(41) F. H. M. asks: 1. Is there any way in which silver can be applied to plastered molding other than as leaf? A. We do not know of any other method. 2. What is the best mixture for lacquering silver to make it like gold? A. Amber 8 ozs., gum lac 2 ozs., drying linseed oil 8 ozs., essence of turpentine 16 ozs. Dissolve separately the gum lac, and then add the amber, prepared and pulverized, with the linseed oil and essence, very warm. When the whole has lost a part of its heat, mix in relative proportions tincture of annatto, of terra merita, gum guttæ, and dragon's blood. This varnish, when applied to white metals, gives them a beautiful gold color. 3. Can bronze be burnished? A. No. 4. Can leaf be applied on a French polished surface? A. No. 5. Which plaster is best for moldings? A. What kind of moldings?

(42) H. E. N. says: I have a galvanic belt, warranted to cure neuralgia, etc., and I want to find out what the actual electric or galvanic intensity is, if it has any. How can I arrive at it? A. Attach its two poles to a tangent galvanometer and note the deflection. Then connect the cell of a Daniell battery to the same galvanometer. The deflection of the galvanic belt will be to the deflection of a Daniell cell as its intensity is to that of a Daniell cell.

(43) W. E. P. asks: 1. What are the properties of crude petroleum? A. The name petroleum (rock oil) is applied to certain bituminous fluids found in the earth. Solid bitumen or asphalt differs but little in chemical composition from petroleum, both being compounds of hydrogen and carbon. Many varieties of petroleum, and perhaps all, become thick by exposure to the air, and finally solid, resembling asphaltum. The fluid petroleum has been collected in Burmah for at least fifteen centuries. It is used by the inhabitants for light and fuel. In this country petroleum is not, as many suppose, a new discovery. Years ago springs of it were known in many localities, but its use was very limited. No method for purifying it was known, so that it was looked upon as valueless, and several wells bored for salt water were abandoned on account of the oil rendering the water impure. In 1861 it was purified, and introduced extensively as an illuminating oil, to take the place of burning fluids (camphine and alcohol), the price of which was greatly enhanced, and which, by the explosive qualities of their vapors, were causing many severe accidents. The trade increased, new wells were bored; and some of them yielded several hundred barrels per day, making possessors at once wealthy. Petroleum was probably formed by a slow decomposition of organic substances under the earth's surface. Some geologists suppose petroleum to be due to the subterraneous distillation of remains of sea plants and marine animals, and that the petroleum is forced upwards by water, always present in the bored wells. It is found in cavities and in crevices, and through the substance of the rock. Petroleum is much lighter than water, of a green or black color, with a peculiar and, to most persons, unpleasant odor. It is commercially divided into two kinds, the heavy or lubricating oil, and the light oil; the former is more dense, and sometimes of the consistence of thin molasses. It is used, without preparation, for lubricating machinery, for which it is admirably suited. The light oil, before it can be used, is submitted to several purifying processes, the most important of which is distillation. 2. What is the simplest method of ascertaining the degree of fire test of refined petroleum? A. Burning oil is sometimes adulterated with benzine or heavy oil. To detect the former, pour a few ounces into a small tin cup, and put it on a stove or over a lamp, placing the bulb of a thermometer in the oil. Then as the temperature rises, try with a lighted taper when the oil gives off inflammable vapor; if this be below 100° or 110° Fah., the oil is dangerous to use, as its vapor, becoming mixed with air in the lamp, may take fire and explode. The adulteration with heavy oil is shown by the dimness of the flame after having burned for some time, accompanied by the charring of the wick. 3. Can kerosene oil be adulterated? How are the adulterations to be detected? A. Yes; it is largely adulterated with the lighter oils, such as benzine, etc., which may be readily detected by the process as described above.

(44) R. R. B. asks: 1. What are the cheapest and best ingredients for making paste in large quantities, for paperhangers' and paper bag manufacturers' use? I want a paste free from lumps and as adhesive as possible; how should the ingredients be mixed, what quantity of each should be used in each barrel, and what should be its consistence before and after cooking? A. The following has been highly recommended; for besides possessing the merit of cheapness, it has the advantage of preventing the paper from separating or peeling off. It may be prepared by first softening 18 lbs. of finely powdered bole in water, and then draining off the surplus water from the mass. One and a quarter pounds of glue are next to be boiled into glue water; and the bole and two pounds of gypsum are then stirred in, and the whole mass forced through a sieve by means of a brush. This is afterward diluted with water to the condition of a thin paste or dressing, when it is ready for use. This paste is not only much cheaper than ordinary flour paste, but it has the advantage of adhering better to whitewashed surfaces, especially to walls that have been coated over several times, and from which the coating has not been carefully removed. In some cases, it is advisable, when putting fine paper on old walls, to coat them by means of this paste with a ground paper, and to apply the paperhanging itself to this with ordinary paste.

(45) A. B. H. asks: 1. Is hot air lighter than cold? A. Yes. 2. Are noxious gases lighter, or heavier than pure air? A. Some are lighter, some are heavier than air. For the most part, however, they are heavier.

1. Does coal slack by exposure to air in a damp place, and does slacking injure it? A. By exposure to the air and damp, the coal loses some of its valuable ingredients, and is injured. 2. Does freezing coal injure it? A. It is also somewhat disintegrated and injured by freezing weather.

(46) G. B. says: I have been trying to electrotype according to the directions given to C. A. C. in your issue of February 6, but my deposit is so brittle that I can hardly get it off the wax whole, and there are minute holes in the work. What is the trouble? A. Too much battery.

(47) W. A. B. asks: Does the zinc rod in the Leclanché battery require to be amalgamated? A. No.

(48) A. W. M. says: In Baker's work on the steam engine, p. 35, I find the following formula for the graduation of the lever of the safety valve: $D=\frac{\pi r^2 l P'-\frac{1}{2}Lw}{W}$ πr^2=area of valve, l=distance of the center of valve to fulcrum, P'=the pressure of steam on boiler, L=length of lever, w=weight of lever, W=weight of ball. I have just put in a set of new boilers. The area of the valve is 5·41189 inches, l=3·125, P'=80 lbs., length of lever 29 inches, weight of lever 8½ lbs., and weight of ball 83 lbs. $D=\frac{\pi r^2 l P'-\frac{1}{2}Lw}{W}=\frac{5{\cdot}41189\times3{\cdot}125\times80-14{\cdot}5\times8{\cdot}5}{83}$ $=14\frac{8}{10}$. $D=14\frac{8}{10}$ inches from fulcrum to place where the weight should be placed on lever to carry 80 lbs. steam. But when we fired up, we were surprised to find that, instead of placing the weight at $14\frac{8}{10}$ inches from the fulcrum, we had to place it 19 inches; we therefore conclude that the formula is incorrect. Can you explain this? A. The formula is approximately correct, and answers pretty well for ordinary cases. We think it likely that you have made a mistake in estimating the area of the valve, or that your steam gage is incorrect. You will find an experimental method described on p. 273, vol. 31.

(49) W. L. L. says: I wish to make a telescope with a 15 inch objective, hollow, to be filled with liquid. What is the best filling? A. Only two kinds of objectives repay the labor bestowed on making them, the achromatic objective and the silvered glass reflector, mounted either according to Newton's or to Cassegrain's form.

(50) W. H. S. asks: What is the proportion between the object and diagonal reflectors in the Newtonian telescope, the focus being six times the diameter? A. Minor axis of elliptical plane mirror is one fifth the aperture of the speculum. The focus should be nearly twelve times the aperture.

(51) R. W. K. says: You state that a generally useful application of paraffin is for the lining of casks and wooden vessels, to prevent absorption of their contents by the wood, or their escape through the pores. The diminishing evaporation being of great importance to the vineyard districts of Virginia, I applied at some of the largest establishments in Philadelphia, and found that such an application of paraffin was an entire novelty to them. Would it not be expensive? A. It is successfully used in coating smaller vessels; its application to larger is a matter only of expense and proper appliances.

(52) J. F. D. asks: What is the best method of bleaching rosin? A. We do not know of any such process.

(53) E. F. asks: Can any simple ingredient be used to throw down the foreign matter in very hard water? A. This may be accomplished either by boiling the water before using, or by the addition of the proper quantity of lime water, which will precipitate or carry down with it the excess of carbonate of lime.

(54) U. H. asks: 1. Can I gold plate steel pens with the Tom Thumb battery? A. Yes. 2. Must I plate the pens with copper first? A. It is not necessary.

How can I mend rubber hose? A. See p. 203, vol. 30.

What is the freezing point of mercury? A. Mercury solidifies at —39° Fah., and is then soft and malleable; but if reduced to a much lower temperature, it becomes brittle. It boils at about 662° Fah., and slowly volatilizes at all temperatures above 40°.

(55) W. L. B. says: Rain water 6 ozs., carmine 24 grains, aqua ammonia 240 drops, and gum arabic water 30 drops make red ink which has an offensive smell. What will remove the smell of the ammonia without spoiling the ink? A. Use a smaller proportion of ammonia.

You give a recipe for white gunpowder. Are the parts by weight? A. Yes.

(56) W. C. R. asks: I. If I take a glass tube, say 6 inches long and ½ inch in diameter, and fill it about half full of the heads of the old sulphur (blue headed) matches, with half an inch of stick to each head, and then seal the two ends of the tube over a blowpipe without igniting the matches, after which I heat the body of the tube hot enough to consume the wood: What gases will I have in the tube? A. The gases will be vapor of sulphur, a small amount of sulphurous acid, water, and pyroligneous acid arising from the destructive distillation of the wood. 2. Will they be of disagreeable odor, or injurious when inhaled? A. They will be both disagreeable and injurious.

(57) M. J. S. says: We have a well forty feet deep, consisting of a three inch pipe driven into the earth, through which the water is drawn. The soil at the bottom of the well is a white sand, and the water drawn therefrom is clear as crystal; but on being heated it becomes red, and precipitates a red sediment, which retains its color when dry. Why is this? A. The water contains iron in solution, existing probably as bicarbonate of iron. Upon boiling, the carbonic acid is driven off and the iron precipitated as red oxide, which remains as an insoluble body.

(58) J. G. asks: What impurities does sheet zinc contain, and how may they be removed so as to leave it comparatively pure? A. Commercial zinc is always more or less contaminated with arsenic, cadmium, lead, iron, and carbon. The black residue remaining when zinc is dissolved in acid (often mistaken for a carburet of zinc) is a mixture in various proportions of iron, lead, and carbon. The more impure the zinc, the more readily it is dissolved in acids; but by careful distillation zinc may be almost entirely freed from any foreign metals.

In a Leclanché cell (1 quart), how often do the contents of the porous cup and of the outer jar require changing? A. This depends altogether upon the use that is made of it, or in other words, the number of times daily or monthly it is brought into requisition. The outer solution simply needs to be kept saturated with sal ammoniac, and water to replenish that lost by evaporation. This battery cannot be used on closed circuit, because of its rapid polarization.

(59) L. W. R. asks: 1. What is the difference in the combination of a portrait and a landscape lens for photography? A. The portrait lens is constructed to work rapidly; the front pair consists of a crown double convex and flint plano-concave, the back pair a flint negative meniscus and crown double convex, of longer focus than the front pair. The view tube is a single pair, a double convex crown and a double concave flint. 2. Why are two sets of lenses used in a camera tube? A. For wider angle of aperture. 3. Can good landscape and portrait photography be done with an achromatic object glass of a telescope? A. No. For experiment, put a view tube its own focal length inside focus of objective. 4. Does a lens of short or long focal length make any difference for either kind of work? A. A lens works the slower the longer its focus is. 5. How is a telescope fixed for viewing the sun? A. Claret and apple green sextant glasses are superposed inside the eyepiece cap, or the image is received on a Bristol board.

(60) J. E. N. asks: 1. What is the best composition for covering the insulated wires for an induction coil? A. Cover both wires with silk. 2. Is a bobbin 6 inches long by 2½ inches in diameter, with a ½ inch cylinder (for the wire rods), a well proportioned one? A. Yes. 3. Which gives the best results with a weak battery, a coil of two wires (of the same size) wound side by side, or a coil of fine over a coarser wire? A. Use No. 40 for the secondary and No. 16 for the primary. 4. Are the induced and the inducing coils wound in the same direction (in the coil of one wire over the other)? A. Yes. 5. In what proportion of each can the induced be increased without increasing the inducing coil? A. Almost any extent. 6. About what quantity of each (by weight) of wire will be required for the above sized bobbin? A. Use a few turns of the coarse wire and a thousand turns of the fine wire. 7. Can iron covered wire be used in place of copper in any part? A. Not to good advantage. 8. What work on electricity is recommended? A. De la Rive, Wood, Jenkins, Harris, Ferguson, and Thomson are all good.

(61) W. R. H. asks: 1. How can I best solder platinum foil to brass and make a good electrical connection? A. Use pulverized rosin and good solder. 2. Will powdered peroxide of manganese act as well as the coarsely pulverized for the Leclanché battery? A. Use the coarse in preference.

(62) F. B. S. says: 1. I have a small battery made on the Daniell principle, using zinc and sulphate of copper, but it is not constant. What can I do to keep it more uniform? A. Probably the water needs changing in the porous cups. When it becomes supersaturated with sulphate of zinc, crystals form on the zinc and stop the action. You can use nitrate of copper instead of sulphate if you wish, but sulphate is cheaper and better. 2. How can I make an induction coil? A. An induction coil is made by winding a helix of coarse insulated copper wire, and surrounding it by a helix of fine insulated copper wire. The battery is connected with the coarse wire coil and the shocks are obtained from the fine wire coil, when the circuit of the coarse wire coil, which is called the primary circuit, is broken and closed. The fine wire coil is called the secondary circuit, and receives its electrical effects by induction from the primary circuit.

(63) W. E. D. asks: How can I make a battery suitable for plating, and how one that will run a small telegraph instrument? I have a glass jar that will hold about 2 quarts, and wish to make it into as powerful a battery as I can. A. Put a plate of copper in the bottom of your jar and attach a copper wire to it which is insulated above the junction with gutta percha. Put a couple pounds of sulphate of copper (blue vitriol) on the copper plate. Suspend a disk of zinc in the jar near the top and fill the jar with water. Connect the upper end of the copper wire with the zinc disk, and leave it so for 48 hours, and your battery will then be ready for use. If you need more power, make a second cell in the same way and connect the copper plate of one with the zinc disk of the other. One cell of this kind has a force of one volt, two cells two volts, and so on. This is called the gravity or Callaud battery, and is one of the best and most constant in use.

(64) W. S. S. asks: Is there a chemical process by which steel can be case-hardened without heating or springing it? A. We do not know of any.

(65) J. H. B. says: I have a little engine of 1 inch bore by 2½ inches stroke. I had some trouble with the valve, but your article on "Practical Mechanism," by Joshua Rose (a couple of weeks ago) corrected the mistake. I now run with steam 20 lbs. pressure at the rate of about 800 revolutions a minute.

(66) E. B. K. says, in reply to J. C. M., who had trouble with pipes connected to his boiler in under side: The trouble was that there was no connection with the steam. If one end of the pipe were connected with the steam, the steam generated would escape to the boiler and form a vacuum, and the water would follow. The size of the pipe makes no difference. It will not do to pump through such pipes.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

C. H. W. Jr.—It is a fragment of a small hexagonal crystal of rock crystal or quartz.—G. H. M.—It is a decomposed muscovite, which is a variety of mica, and consists of a hydrated silicate of alumina, with a small percentage of oxide of iron and about 10 per cent of alkali. Numerous specimens of this mineral have been forwarded of late, probably on the supposition that the bright yellow scales owe their color to the presence of gold. This mistake was made with sad consequences by the first settlers at Jamestown, Va., who, instead of devoting themselves to cutting down the forest, collected a shipload of similar material and sent it to England, where it was pronounced worthless.—D.K.—No. 1 is bornite or variegated copper ore, composed of sulphur 25 per cent, copper 63 per cent, and iron 12 per cent. No. 2 is epidote, and consists of 37 per cent of silica, 23 per cent of alumina, 14 per cent of oxide of iron, 23 per cent of magnesia, and 3 per cent of water.—T. M. T.—It is a mixture of augite, epidote, and quartz. If it contains any tin ore, it is not perceptible to the eye, and a piece much larger than the microscopic fragment you send would be necessary to determine this fact. It has no value, apparently, as an ore.—N. H. S.—We have tried your specimen for manganese, and find it present, although in what quantity we cannot say from a preliminary examination. The cost of an assay is $10; and if there is a deposit of the mineral, it is worth the assay.—G. McI.—The pill is probably a proprietary article; it has all the indications of being for sweetening the breath only.—J. K.—No. 1 is marcasite, and is composed of 46 per cent of iron and 54 of sulphur. It is not valuable as an iron ore. No. 2 is a clay slate, containing oxide of iron, but not in sufficient quantity to render it valuable. No. 3 is an impure steatite or soapstone. In large blocks, it is used in lining the interior of blast furnaces. No. 4 is a yellow oxide of iron, mixed with clay and a large amount of silex. It is an inferior iron ore.—Y. and K.—The specimen contains gold, of the variety known in works on mineralogy as "fool's gold," or iron pyrites. It is full of cubical crystals—slightly decomposed—of iron pyrites, which is a compound of sulphur and iron.—P. C.—The white particles are not sulphur, but sulphate of iron arising from the decomposition of pyrites. The vitriol has probably been made in the same manner, and a larger specimen would be needed for analysis.—An unlabeled mineral of a bright metallic luster, slight yellow tint, broken on the side with a fibrous fracture, and having an appearance at the ends of having undergone fusion, has been received. It is sulphuret of iron.

J. & J. T. ask: What is the proper speed for the periphery of a bolting reel?—J. H. asks: How can I dye skins of muskrat, fox, etc., black?—R. M. asks: How can I prepare Prussian blue for stenciling, to be used, moistened with water, with a brush?—R. S. asks: What is a hit and miss valve?—J. C. C. asks: 1. How can ginger ale with a round, full, aromatic body be made? 2. What are the component parts of the Belfast ginger ale?—T. W. B. asks: If four men can pack a bale of cotton weighing 500 lbs. on an iron screw 4 inches in diameter and 1¼ inches pitch in the thread to the round, with levers 15 feet long, how much can four men pack with a wood screw 22 inches diameter and 7 inches pitch in the thread to the round, with levers 20 feet long? The incline on the wood screw is as 7 to 69⅟, and the incline on the iron screw is as 1¼ to 12¼, that is, the incline on both is nearly the same, but the rise on one is 7 inches to the round, and on the other 1¼ inches to the round.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Boiler Explosions. By W. H.
On a Mysterious Fire. By J. B. G.
On a Magnetic Engine. By H. L. C.
On Lubricating Cylinders. By J. H. S., and by C. T. S.
On an Optical Phenomenon. By C. E. F.
On Nitro-Glycerin as a Motor. By C. T.
On Amalgam Fillings. By F. H. H.
On a Man-Eating Tree. By K. L.
On Ants. By J. S.

Also enquiries and answers from the following:
D. O.—M. P. C.—J. B. E.—J. E. B.—W. C. T.—A. F. A. F. O.—G. C. S.—H. C. L.—J. S. B.—J. W.—R.—F. J. D.—J. F. F.—B. C. & Co.—D. F. S.—W. B. R.—E. E. E.—S. A. H.—P. E. V. H.—J. M. R.—W. H. S.—H. L. F. M.—B. J. J.—C. H. B.—W. M. H.—R. G. S.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Who sells eccentric grinding mills? Who sells a gold plating liquid? Who sells match-making machines? Who deals in fossils? Who makes pocket door locks? Who buys old coins?" All such personal enquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week ending January 26, 1875,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Air compressor, Carobbi & Bellini	159,075
Aerating apparatus, G. W. Baird	159,142
Axle box and sleeve, J. B. Winchell	159,240
Bale tie, J. B. Arrants	159,060
Bale tie, A. A. Goldsmith	159,089
Baling cotton, device for, W. Iler	159,098
Barrel, G. W. Banker	159,064
Barrel heads, cutting, O. Osten	159,114
Bed bottom, spring, Fowler & Dewar	159,086
Bee hive, J. S. Coe	159,081
Boats, towing, G. Burnham	159,151
Boiler feeder, etc., J. W. Hopkins	159,095
Boiler, wash, S. M. Marsden	159,196
Boiler water indicator, O. B. Kendall	159,184
Boilers, etc., covering for, W. O'Hara	159,206
Bolt fastening, E. H. Pettit	159,161
Boot, gaiter, B. C. Young	159,135
Boot stiffeners, making, R. Rogers	159,220
Boring machine, G. Dryden	159,164
Bottle stopper, C. M. Blydenburgh	159,067
Bottle stopper, etc., F. B. Michell	159,200
Box, revolving spice, T. W. F. Smitten	159,122
Boxes, wooden, A. Robinson	159,042
Bracelet, E. F. Presbrey	159,214
Bridge, iron, E. I. Farnsworth	159,084
Bridges, joint for iron truss, E. S. Shaw	159,046
Bridge, post or girder, F. C. Lowthorp	159,194
Bridle bit, P. Casey	159,077
Bristles, combing, Parks & Lannay	159,209
Buildings, movable front for, J. Murphy	159,203
Burial casket, W. G. Algeo, Sr. & Jr.	159,059
Burner, self-regulating gas, D. D. McMillan	159,108
Burners, lens for gas, M. C. Meigs	159,199
Button, sleeve, Mason & Richardson	159,106
Car birth, sleeping, C. E. Lucas	159,195
Car coupling, A. A. Kellogg	159,099
Car coupling, G. W. E. Row	159,120
Car coupling, Tuttle & Thompson	159,125
Car coupling, L. Vote	159,128
Car ventilator, E. Korting	159,187
Car wheel and axle, B. A. Berryman	159,145
Cars, truck for street railway, H. C. Bull	159,070
Carpet fastener, A. Burroughs	159,153
Carriage wheel fender, A. Shoeninger	159,047
Cartridge loading device, G. W. Ansley	159,013
Chain gripe, etc., J. N. & G. J. Ackerman	159,057
Chair, folding, P. W. Nolan	159,205
Cheese mill, J. F. Landis	159,189
Churns, cream saver for, R. Whiting	159,237
Cigar mold, N. Dubrul	159,165
Cisterns, walling, F. Wilford	159,239
Clasp for stockings, etc., G. J. Capewell	159,154
Clock frame or case, H. J. Davies	159,160
Clothes line, T. S. Cary	159,076
Connecting rod, J. F. Haskins (r)	6,255
Crop thinning machine, M. Eustace	159,169
Croquet mallet, T. H. Logan	159,193
Cutter head, G. J. Shimer	159,226
Dairies, cooling, J. Wilkinson	159,055
Demijohn, C. Newman	159,038
Dental engines, protecting, E. T. Starr	159,048
Dental plugger, L. J. P. E. Gaillard	159,173
Dental tool, electromagnetic, G. F. Green	159,028
Derrick, C. L. Duroy	159,024
Ditching machine, T. F. Randolph	159,118
Dredging machine, C. J. Sands	159,223
Drilling machine, rock, E. S. Winchester	159,242
Drill supporting clamp, E. S. Winchester	159,241
Dryer for fertilizers, Bowman & Chapman	159,147
Egg holder, A. W. Porter	159,213
Engine, rotary, J. V. Beekman	159,066
Engine, rotary, Deming & Wickes	159,023
Engine cut-off, H. Webster	159,130
Fan, E. Schmidt	159,224
Feather renovator, Russell & Seamans	159,222
Felt, vegetable, Sweeney & Beach	159,051
Fence, farm, I. L. Landis	159,188
Fifth wheel for vehicles, G. F. Putnam	159,117
Fire extinguisher, H. S. Parmelee (r)	6,257
Flue cover, H. Tongue	159,231
Furnace boiler, W. Allensworth	159,138
Furnace doors, etc., opening, G. Lees	159,190
Furnace grate, C. Knoblauch	159,186
Furnace grate, H. Ryder (r)	6,259
Furnace, metallurgic heating, R. Ragot	159,039
Furnace, puddling, H. Ragot	159,040
Furnace, smoke-consuming, Argerbright et al.	159,141
Furnace steam distributer, A. B. Corey	159,156
Gas light indicator, etc., W. W. Goodwin (r)	6,254
Gas machine, J. C. Henderson	159,179
Gas meter register, H. H. Edgerton (r)	6,258
Gas regulator, J. Anderson	159,139
Gear wheels with shafts, connecting, J. Rosebrook	159,221
Generator, steam, Whittingham (r)	6,262
Generator, steam, H. C. Bull	159,069
Generator, steam, W. E. Haxtun	159,178
Glass articles, etc., mold for, T. B. Atterbury	159,061
Glass mold, B. Bakewell, Jr.	159,062
Grain binder, J. M. Groover	159,176
Grain dryer, H. H. Beach	159,014
Grain, hulling and scouring, L. S. Chichester	159,080
Grain for grinding, moistening, W. M. Kennedy	159,100
Harrow and planter, B. Butler	159,073
Harrow and roller, W. R. Downing	159,163
Harvester, cotton, L. K. Miller	159,109
Hat block, F. R. Going	159,088
Heater radiator, steam, C. Comstock	159,155
Heater, water, S. L. Latta	159,103
Hog trap, J. Klar	159,185
Hoist or elevator, cellar, C. D. Walters	159,233
Horse power, J. M. Alberison (r)	6,247
Horseshoe, B. Lee	159,191
Hygroscope, Seebass & Simon	159,043
Inhaler and nasal douche, E. Schofield (r)	6,260
Ironing board, S. B. Morrell	159,111
Jack, lifting, W. F. Morrow	159,202
Jeweler's lathe, N. W. Holt	159,180
Kiln, brick, W. Bull	159,072
Kiln, brick, W. L. Gregg	159,091
Ladder, fire escape, M. Davis	159,022
Ladder, step, R. S. Van Zandt	159,126
Lamp cap and shade holder, W. R. Park	159,208
Lamp wick inserter, W. H. Fitz Patrick	159,171
Leather, stretching, C. D. Castle (r)	6,252
Leather, finishing, Groff & Marvel	159,093
Lens attachment for gas burners, M. C. Meigs	159,199
Letter box indicator, H. R. David	159,083
Liquids, drawing effervescent, T. Warker	159,054
Lock, alarm, J. Walton	159,129
Loom temple, E. S. Stimson	159,050
Map exhibitor, S. C. Adams	159,058
Metal-creasing machine, G. W. and C. P. Howell	159,096
Meter, W. R. Baker	159,143
Mill, rolling, Chalfant and Hahn	159,078
Millstones, dressing, J. Williams	159,133
Motor for light machinery, D. Baldwin	159,063
Mower, lawn, H. T. West	159,131
Music leaf turner, W. H. King	159,101
Musical merchandise box, J. Restein	159,218
Nail-assorting machine, J. Coyne	159,082
Newspaper heads, changing, P. Forsyth	159,172
Nursing bottle, J. L. Mason	159,197
Nut lock, J. J. Adgate	159,136
Ordnance, breech-loading, G. H. Felt	159,170
Ore concentrator, Moore and Campfield	159,110
Ox shoe, R. French	159,026
Paddle wheel, feathering, B. Vater	159,127
Paper bag, T. W. Grinter	159,029
Paper bag machine, T. W. Grinter	159,030
Paper ruling machine, T. F. Collins	159,018
Pavement, wood, W. Disney	159,162
Pawl and ratchet, Tomlinson and Smith	159,124
Pawl and ratchet mechanism, J. L. Bond	159,016
Photograph burnisher, A. C. Moestue	159,035
Piano lid prop, D. P. Ramsdell	159,041
Picture exhibitor, C. S. Mills	159,201
Picture rod molding, A. C. Funston	159,027
Pipes, molding clay, W. K. Black	159,146
Planter, rice, J. C. Braud	159,148
Planter, seed, J. G. Garner	159,087
Planters, check cord for, G. D. Haworth	159,177
Plow, G. Hale	159,174
Pocket tool, F. R. Woodward	159,134
Printing, gelatin plates for, E. Edwards	159,166
Printing, etc., photo relief, Levy and Bachrach	159,104
Pruning implement, E. E. Stedman (r)	6,261
Pulleys, flask for casting, W. Hutton	159,097
Pump, A. A. Burr	159,152
Pump bucket, chain, J. Neil	159,037
Quicksilver strainer, H. H. Oakes	159,118
Quilting frame clamp, A. P. Grabham	159,090
Radiator, steam heater, C. Comstock	159,155
Railway crossing, J. Cumming	159,158
Sash holder, H. C. Perry	159,212
Sash supporter, H. F. Jenks (r)	6,256
Saw handle, E. Andrews	159,140
Saw mill head block, Whitcomb and Rawson	159,236
Scaffold, Lapp and Sweet	159,032
Scarf, A. Mueller	159,112
Seeding machine, C. E. Patric	159,210
Sewing machine, Bartlett and Plant	159,065
Sewing machine, E. Kappmeyer	159,183
Sewing machine ruffler, E. W. Darby	159,020
Sewing machine table support, R. W. Whitney	159,235
Sewing machine wax thread, E. E. Bean	159,144
Shaft support, S. Nellis	159,204
Sheep scratch box, I. B. Dillon	159,161
Shoe blacking case, C. P. Ellis	159,167
Shoe horn, A. M. Cushing	159,159
Shoe nail blank, Blake and McKay	159,015
Shoe tips, machinery for forming, J. H. Hussey	159,181
Sleigh, T. F. Moore	159,036
Spark arrester, D. Allard	159,187
Spark arrester, J. W. Buel	159,017
Spinning frame, bolster, J. A. Matteson	159,084
Spoke socket and felly plate, H. T. Briggs	159,149
Spooling machine bobbin supporter, A. M. Wade	159,053
Staple blanks, making, J. W. Shannon	159,044
Stone, wheel for dressing, P. B. Laird	159,031
Stool support, C. J. Woodward	159,243
Stove, cooking, M. D. Seward	159,225
Stove, heating, N. A. Boynton (r)	6,251
Stove lid lifter, G. Sprague	159,228
Stove, magazine, J. E. Tallmadge	159,052
Stove pipe collar and thimble, G. F. Brinkerhoff	159,150
Stove polish, S. J. Wilson	159,056
Strainers, construction of, R. J. P. Goodwin (r)	6,248
Street sprinkler, G. A. Jeremiah	159,182
Street sweeping machine, J. Edson	159,025
Surveyors, target for, T. Davies	159,021
Syringe, hypodermic, J. Leiter	159,192
Table, folding, H. B. Sinclair	159,227
Tea pot handle, T. Shaw	159,121
Telegraph pole, metallic, R. D. Radcliffe	159,215
Tiles, manufacturing, E. L. Hall	159,093
Tobacco, coloring, O. Knab	159,102
Toy cartridge exploder, J. B. McHarg	159,107
Trap, animal, L. F. George	159,175
Trunk fastener, A. Frankel	159,085
Twine cutter, C. P. Ellis	159,168
Tyre tightener, H. B. Robbins	159,219
Umbrella, W. Tetley	159,230
Valve, automatic relief, L. D. Shaw	159,045
Valve, safety, H. C. Bull	159,068
Valve, safety, G. H. Crosby	159,157
Valve, steam, J. H. Corey	159,019
Valve, steam, G. McNaughton	159,198
Valve, adjusting cut-off, H. C. Bull	159,071
Vehicle wheel, J. M. Stephenson	159,049
Vehicle wheel hub, W. Teegarden	159,123
Velocipede, J. A. Vander Waag (r)	6,250
Ventilating and warming drum, P. H. Carman	159,074
Ventilator, car, E. Korting	159,187
Vise, E. Parker	159,115
Wagon bodies, stay iron for, A. A. Livingston	159,033
Wagon, dumping, Patton and Walters	159,211
Wagon jack, S. Chard	159,079
Washers, machine for forming spiral, S. Trethewey	159,232
Washing machine, S. W. Holbrook	159,094
Watch case bezels, making, F. H. Wilby	159,238
Water, removing obstructions under, S. Lewis (r)	6,240
Wells, increasing capacity of oil, E. A. Roberts (r)	6,238
Whip tip ferrule, E. B. Light	159,105
Windmill, W. D. Parson	159,207
Wood, machine for polishing, S. G. Randall	159,216
Wrench, S. E. Robinson	159,119
Wrench, pipe, H. C. Stouffer	159,229
Wrench, pipe, J. B. Westwick	159,234
Yoke, neck, J. B. Relyea	159,217

DESIGNS PATENTED.

8,019.—CLOCK FRAME, ETC.—H. J. Davies, Brooklyn, N. Y.
8,020.—COOK STOVE.—L. W. Harwood et al., Troy, N. Y.
8,021 to 8,024.—OIL CLOTHS.—C. T. Meyer et al., Bergen, N.J.
8,025, 8,026.—COOK RANGES.—N. S. Vedder et al., Troy, N.Y.
8,027 to 8,033.—CARPETS.—J. T. Webster, Philadelphia, Pa.
8,034.—BOAS.—G. H. Prindle, Philadelphia, Pa.
8,035.—COOK STOVE.—N. S. Vedder et al., Troy, N. Y.

TRADE MARKS REGISTERED.

2,185.—WASHING SODA.—Fischer & Co., New York city.
2,186.—DRUGS.—E. Fougera & Co., New York city.
2,187.—CARPET TACKS.—F. F. McNair, Nunda, N. Y.
2,188.—JEANS.—Naumkeag Cotton Co., Salem, Mass.
2,189.—HAMS.—C. D. Sabin, New York city.
2,190.—WOOL.—J. H. Smith, Philadelphia, Pa.
2,191.—MINERAL WATERS.—H. A. Benjamin, San Francisco, Cal.
2,192.—BRAIDS.—H. N. Daggett, Attleborough, Mass.
2,193.—SILKS, ETC.—Passavant & Co., New York city.
2,194.—SOAPS.—Strunz et al., Pittsburgh, Pa.
2,195.—SPRING BEDS.—Tucker Man. Co., Boston, Mass.
2,196.—KNITTED GOODS.—Troy Hosiery Co., Troy, N. Y.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,

JANUARY 25 to JANUARY 28, 1874.

4,307.—H. H. Rhodes, San José, Santa Clara county, Cal., U. S. Improvements in railroad car axles, called "Rhodes' Railroad Car Axle." Jan. 25, 1875.

4,308.—W. Gooding, Detroit City, C. Spalding and A. Winchester, Windsor, Essex county, Ont. Improvements on apparatus for elevating and conveying coal, called "The Shipping Coal Elevator." Jan. 25, 1875.

4,309.—A. J. O'Day, Elk Rapids, Antrim county, Mich., U. S. Improvements in ore crushing and rock breaking machines, called "O'Day's Improved Ore Crusher." Jan. 25, 1875.

4,310.—G. M. Holmes, Gardener, Kennebec county, Me., U. S. Improvements on mechanism for planing the cogs of bevel gear wheels, called "Holmes' Gear Wheel." Jan. 25, 1875.

4,311.—Wm. Hamilton, Fallsburg, Sullivan county, N.Y., U. S. Improvements in machine for making animal shoes, called "Hamilton's Machine for Making Animal Shoes." Jan. 25, 1875.

4,312.—J. Prince, Rock Island, Stanstead county, P. Q. Improvements on an apparatus for cooling milk, called "Prince's Improved Milk Vat Pan." Jan. 25, 1875.

4,313.—D. Allard, St. Albans, Franklin county, Vt., U.S. Improvements on smoke stacks, called "Allard's Smoke Stack." Jan. 25, 1875.

4,314.—C. E. Moyer, Berlin, Waterloo county, Ont. Improvements on shoe lasts, called "Moyer's Improved Patent Felt Shoe Last." Jan. 26, 1875.

4,315.—J. K. Feick, Berlin, Waterloo county, Ont. 1st extension of No. 2,234, on "Feick's Patent Last." Jan. 26, 1875.

4,316.—J. K. Feick, Berlin, Waterloo county, Ont. 2d extension of No. 2,234, on "Feick's Patent Last." Jan. 26, 1875.

4,317.—H. Sappe, New York city, N. Y., U. S. Improvements on faucets, called "Sappe's Self Closing Faucet." Jan. 26, 1875.

4,318.—Wm. Crich, Tuckersmith township, Huron county, Ont. Improvement on spring bed bottom, called "Crich's Improved Spring Bed." Jan. 26, 1875.

4,319.—L. Dion and A. Dion, St. Thomas, Montgomery county, P. Q. Un attelage de wagon de chemins de fer, dit "Attelage de Wagon de Dion & Fils." Improvements in railway car couplers.

4,320.—J. F. Webster, Hamilton, Wentworth county, Ont. A leaf supporter for sewing machines, called "Webster's Leaf Supporter." Jan. 25, 1875.

4,321.—R. Sylvester, Enniskillen, Durham county, Ont. Improvements in spring hoe seeding machine, called "Sylvester's Improved Spring Hoe." Jan. 26, 1875.

4,322.—E. C. Scarlett, Adolphustown, Lennox county, Ont. Improvements in the manner of coupling and uncoupling railroad cars, called "Scarlett's Car Coupling." Jan. 26, 1875.

4,323.—S. J. Wright, Madrid, and A. H. Wood, Ogdensburgh, St. Lawrence county, N.Y., U. S. Improvement on watchman's patrol register, called "Wright & Wood's Watchman's Permanent Control Clock." Jan. 26, 1875.

4,324.—R. H. Atwell, Baltimore, Md., U. S. Improvements on motors or engines to be driven by either water or steam, called "Atwell's Motor for Steam or Water." Jan. 28, 1875.

4,325.—G. A. Jasper, Boston, Suffolk county, Mass., U.S. Improvements in methods for promoting the combustion of fuel in furnaces, called "The Jasper Furnace." Jan. 28, 1875.

4,326.—J. Conrad and J. H. Fahringer, Montoursville, Lycoming county, Pa., U. S. Improvements on apparatus for elevating building materials, called "Conrad's and Fahringer's Apparatus for Elevating Building Material." Jan. 28, 1875.

Advertisements.

Advertisements.

Back Page - - - - - - - - $1.00 a line.
Inside Page - - - - - - - - 75 cents a line.

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

HOUGHTON'S AUTOMATIC HOUSE PUMP, Operated by the surplus heat of the cooking fire, draws water from the well or cistern and forces it to the tank at the top of the house, without attention or expense. Skillful mechanics wanted to make and introduce them in various parts of the country. For description and particulars, address (with stamp) CHARLES HOUGHTON, 40 Water Street, Boston, Mass.

WELLS' EVERY MAN HIS OWN LAWYER AND BUSINESS FORM BOOK. By JOHN G. WELLS. **A Complete Guide in all Matters of Law and Business Negotiations.** ☞ FOR EVERY STATE IN THE UNION. ☜ With full Instructions for Proceeding Without Legal Assistance in Suits and Business Transactions of every description. Containing: Legal Forms of Deeds, Mortgages, Leases, Affidavits, Depositions, Bonds, Orders, Contracts Powers of Attorney, Certificates of Citizenship, Agreements, Assignments, Awards, Declarations, Demands, Letters of Credit, Arbitration, Partnership, Releases, Wills, Codicils, Submissions, Land Jointures, Tenants' and Landlords' Receipts, Public Lands, Land Warrants, Composition with Creditors, Oaths, Satisfaction of Mortgages, Pre-emption Laws, Marriage and Divorce, Patent Laws, with full Instructions to Inventors; Pension Laws, with full instructions to enable the discharged soldier or sailor to procure back pay, pensions, bounties, and all war claims; the Laws of the Different States concerning Property Exempt from Execution, Collection of Debts, Mechanics' Liens, Contracts, Limitation of Actions, Usury, Qualifications of Voters, Licenses to Sell Goods, etc. Also, containing the Internal Revenue Laws, Stamp Duties, Post-Office and Custom-House Regulations, Constitution of the United States, with Amendments, the whole action of the Government in Relation to Reconstruction and the Freedman, Seals of the Different States, with descriptions, etc.

There is no class of the community, male or female, who have, or expect to have any property, or who have any rights or privileges which require protection, who will not be greatly benefited and advantaged by the possession of the book. It will save them money, save them trouble, save them time, save them litigation and lawyers' fees, and give them information which nobody can afford to be without.

The Work embraces 650 large 12mo. pages, and is printed on fine paper, handsomely bound.

Price, Cabinet Library Binding..............$2.25

Address JOHN G. WELLS, No. 27 Clinton Place, New York.

IT PAYS! IT PAYS!

WHAT PAYS?

Read & See

Every business man admits the necessity of advertising. All who have tried it know the advantages and profit of so doing. But it is not all who advertise that do it advantageously, and in the most effective manner, to derive the greatest benefit for their money. As a rule, it is the best economy to advertise what one has to sell or wishes to purchase, in papers having the largest circulation among that class of persons likely to be interested in the article. Parties having Manufacturing Establishments to sell or lease, or who wish Estimates made for Constructing Bridges, Dams, Iron Buildings, Furnaces, Heating Apparatus, Steam Engines, Boilers, Wood and Iron Working Machinery, Agricultural Implements, or Contracts for Engineering Works of all kinds, will find that it pays to advertise in the SCIENTIFIC AMERICAN.

The value of the SCIENTIFIC AMERICAN as an advertising medium cannot be over-estimated. It goes into all the machine and workshops in the country, and is taken at the principal libraries and reading rooms in the United States and Europe.

A business man wants something more than to see his advertisement in a printed newspaper. He wants circulation. If it is worth 25 cents per line to advertise in a paper of three thousand circulation, it is worth $3.75 per line to advertise in one of forty-five thousand.

We invite the attention of those who wish to make their business known, to the annexed rates:

Back Page, - - -	$1.00 a line	EACH INSERTION.
Inside Page, - - -	.75 a line	
Business and Personal,	1.00 a line	

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at the publication office as early as Friday morning to appear in next issue.

If anything is wanted in the mechanical line, advertise for it in the SCIENTIFIC AMERICAN.

If one has a patent or machinery to sell, advertise in the SCIENTIFIC AMERICAN.

Address the publishers,

Munn & Co.,
37 Park Row, New York.

PATENT COLD ROLLED SHAFTING.

The fact that this shafting has 75 per cent greater strength, a finer finish, and is truer to gage, than any other in use, renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS, Try Street, 2nd and 3rd Avenues, Pittsburgh, Pa.
☞ Stocks of this Shafting in store and for sale by FULLER, DANA, & FITZ, Boston, Mass. GEO. PLACE & CO., 121 Chambers street, N. Y. PIERCE & WHALING Milwaukee, Wis.

WOOD-WORKING MACHINERY GENerally, Specialties, Woodworth Planers and Richardson's Patent Improved Tenon Machines. Central, corner Union St., Worcester, Mass. WITHERBY RUGG & RICHARDSON.

RICHARDSON, MERIAM & CO., Manufacturers of the latest improved Patent Daniels' and Woodworth Planing Machines Matching, Sash and Molding, Tenoning, Mortising, Boring, Shaping, Vertical and Circular Re-sawing Machines, Saw Mills, Saw Arbors, Scroll Saws, Railway, Cut-off, and Rip-saw Machines, Spoke and Wood Turning Lathes, and various other kinds of Wood-working Machinery. Catalogues and price lists sent on application. Manufactory, Worcester, Mass. Warehouse, 107 Liberty Street, New York. 17

Machinery of Improved Styles for making **SHINGLES HEADING, AND STAVES** Sole makers of the well known IMPROVED LAW'S PATENT SHINGLE AND HEADING SAWING MACHINE. For circulars address TREVOR & CO., Lockport, N. Y.

LE COUNT'S PATENT LATHE DOGS, both Steel and Iron; Iron and Steel Clamps, Expanding Mandrels, &c. Sold at wholesale prices during the hard times. Send for Illustrated List to C. W. LE COUNT, South Norwalk, Conn.

$2400 Yearly to Agents. 54 new articles and the best Family Paper in America, with two $5 Chromos. Family Journal, 300 Br'way, N. Y.

ASBESTOS MATERIALS

ROOFING, SHEATHING, BOILER FELTING, PAINTS (all colors), ROOFING PAINT, CEMENTS, &c., prepared ready for use. Send for Pamphlets, Price-Lists, &c. Liberal inducements to dealers.

☞ CAUTION.—*The public are hereby cautioned against purchasing or using any materials for the above or similar purposes, purporting to contain ASBESTOS, unless they bear our name and dates of patents.*

Patentee and Sole Manufacturer, ESTABLISHED 1858. H. W. JOHNS, 87 Maiden Lane, N. Y.

MACHINIST TOOLS For Sale Cheap.

Owing to the removal of our factory, we will at once dispose of such tools generally found in a first-class machine shop. Send for catalogue and prices.

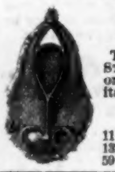
Parties desiring to start a jobbing shop can find no better location and easy terms. Address SUPT. BURRITT, 330 Delancy St., New York.

DAMPER REGULATORS **BEST** AND LEVER GAGE COCKS. **MURRILL & KEIZER. 44 Holliday St., Balt.**

NOYE'S
Mill Furnishing Works

are the largest in the United States. They make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys and Gearing, specially adapted to flour mills. Send for catalogue.
J. T. NOYE & SON, Buffalo, N. Y.

C. HENRY HALL & CO., 20 Cortlandt St., N.Y. City.



THE PULSOMETER.

The simplest, most durable and effective STEAM PUMP now in use. Will pump gritty or muddy water without wear or injury to its parts. It cannot get out of order.

Branch Depots:
11 Pemberton Square, Boston, Mass.
1327 Market St., Philadelphia, Pa.
59 Wells St. Chicago, Ill.

Do Your Own Printing
$9 Press for cards, labels, envelopes etc. Larger sizes for large work. **Business Men** do their printing and advertising, save money and increase trade. **Amateur Printing,** delight ful pastime for spare hours. **BOYS** have great fun and make money fast at printing. Send two stamps for full catalogue presses type etc, to the Mfrs KELSEY & CO. Meriden, Conn.

Wire Rope.

SWAN HEMP & WIRE ROPE WORKS G.B.&Co L

STEEL AND CHARCOAL IRON

Of superior quality, suitable for mining and hoisting purposes, inclined planes, transmission of power, etc. Also Galvanized Charcoal and B B for Ships' Rigging, Suspension Bridges, Derrick Guys, Ferry Ropes, &c.

A large stock constantly on hand, from which any desired lengths are cut.

JOHN W. MASON & CO., 43 Broadway, New York.

Portland Cement.

From the best London Manufacturers. For sale by JAMES BRAND, 55 Cliff St., N.Y.
A Practical Treatise on Cement furnished for 25 cents.

DICK'S ENCYCLOPEDIA OF 6,422 RECEIPTS AND PROCESSES. Price $5. Sent free of postage. Specimen Index mailed free.
DICK & FITZGERALD, Publishers, 18 Ann St., N.Y.

BUY A SWAIN. The Most Powerful, and the Only Tight Shutting, Good Part Gate Turbine ever made. Price of small wheels to suit the times. Send address to A. M. SWAIN North Chelmsford, Mass.

NON-COMBUSTIBLE STEAM BOILER & PIPE
COVERING

Saves ten to twenty per cent. CHALMERS SPENCE CO., foot E. 9th Street, N.Y.; 1202 N. 2nd St., St. Louis, Mo.

Working Models

And Experimental Machinery, Metal or Wood, made to order by J. F. WERNER, 62 Center St., N.Y.

EX INUTILI UTILITAS — TRADE TANITE MARK

The TANITE EMERY WHEEL

Is a rotary file which runs a mile in a minute, and whose cutting points never grow dull. THE TANITE COMPANY publish monthly a first-class Mechanical Journal, called **The Emery Grinder,** which is printed in English, German, and French, and which is the best advertising medium known, both for this country and Europe. THE TANITE COMPANY publish an illustrated pamphlet of 126 pages.

THE TANITE COMPANY manufacture the most uniform and reliable Emery Wheels ever made, and are constantly getting up novelties in Emery Grinding Machinery. For Emery Wheels, Emery Grinders, Diamond Tools, Newman's Emery Planers, Suction Fans, Davis' Speed Indicators, &c.

Address THE TANITE CO., STROUDSBURG, MONROE CO., PA.

TANNATE OF SODA, SCALE PREVENTIVE

Pays for itself tenfold in **money** saved. Applicable to all boilers and all waters. We, without charge, estimate hardness of water and fitness for boilers; analyze incrustations, and give special suggestions for removing the same in refractory cases. Agents in large cities. Send for Book. JOS. G. ROGERS & CO., Madison, Ind.

IMPORTANT FOR ALL LARGE CORPORATIONS AND MANUFACTURING CONCERNS.—**Buerk's Watchman's Time Detector,** capable of controlling, with the utmost accuracy, the motion of a watchman or patrolman, as the same reaches different stations of his beat. Send for a Circular.
J. E. BUERK, P. O. Box 1,057, Boston, Mass.
N. B.—This detector is covered by two U. S. Patents. Parties using or selling these instruments without authority from me will be dealt with according to law.

Munn & Co.'s Patent Offices.

Established 1846.

The Oldest Agency for Soliciting Patents in the United States.

TWENTY-EIGHT YEARS' EXPERIENCE.

MORE PATENTS have been secured through this agency, at home and abroad, than through any other in the world.

They employ as their assistants a corps of the most experienced men as examiners, specification writers, and draftsmen that can be found, many of whom have been selected from the ranks of the Patent Office.

SIXTY THOUSAND inventors have availed themselves of Munn & Co.'s services in examining their inventions, and procuring their patents.

MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine inventions, confer with inventors, prepare drawings, specifications, and assignments, attend to filing applications in the Patent Office paying the government fees, and watch each case step by step while pending before the examiner. This is done through their branch office, corner F and 7th Streets, Washington. They also prepare and file caveats, procure design patents, trademarks, and reissues, attend to rejected cases (prepared by the inventor or other attorneys), procure copyrights, attend to interferences give written opinions on matters of infringement, furnish copies of patents: in fact attend to every branch of patent business both in this and in foreign countries.

Patents obtained in Canada, England, France, Belgium Germany, Russia, Prussia, Spain, Portugal, the British Colonies, and all other countries where patents are granted.

A special notice is made in the SCIENTIFIC AMERICAN of all inventions patented through this Agency, with the name and residence of the patentee. Patents are often sold, in part or whole, to persons attracted to the invention by such notice.

A pamphlet of 110 pages, containing the laws and full directions for obtaining United States patents, also a circular pertaining exclusively to Foreign Patents, stating cost for each country, time granted, etc., sent free. Address

MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, N. Y.
BRANCH OFFICE—**Corner F and 7th Streets** Washington D. C.

ENGINES AND BOILERS, New and Second-Hand Portable and Stationary. For description, address GOODWIN & WHITE, Oil City, Pa.

THE HEALD & CISCO Patent Centrifugal Pumps.

VERTICAL & HORIZONTAL.
First Premiums at New Orleans, Cincinnati, and New York. *"Medal of Special Award,"* American Institute, 1872.

Perfect satisfaction guaranteed. The cheapest, most durable, popular and successful Pump known, for Paper Makers, Tanners, Contractors, Brick Makers, Distillers, etc. Pumps with engine on frame, complete, at low figures, for Wrecking, Dredging, Irrigating, etc. Illustrated pamphlet, free. 300 references to parties actually using the Pump. 24 pages of the strongest possible testimony. Address HEALD, SISCO & CO. Baldwinsville, N.Y.

GREATEST INVENTION of the AGE.
ELECTRIC & VAPOR CHAIR.

See engraving and description in the "Scientific American" of March 7. The greatest known cure for rheumatism and sciatica. No physician should be without one. Send for circular.
C. R. TOWNSEND, SOLE AGENT.
Medical Institute 168 Cumberland St., Brooklyn, N. Y.

KIDDER'S PASTILES—A SURE RELIEF FOR *ASTHMA.* STOWELL & CO., Charlestown, Mass.

THE ADJUSTABLE BROILER.
Patent For Sale. A practical good thing—two patents secured. Will sell the U. S. for $1500—owing to other business already established requiring my entire attention.
W. C. CHAMBERLAIN, Dubuque, Iowa.

The Toll-Gate! **Prize Picture** sent free! An ingenious gem! **50** objects to find! Address with stamp, E. C. ABBEY, Buffalo, N.Y.

HARTFORD STEAM BOILER Inspection & Insurance COMPANY.

W. B. FRANKLIN, V. P't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec.
HARTFORD, CONN.

Todd & Rafferty Machine Co.

MANUFACTURERS OF
The celebrated Greene Variable Cut-Off Engine; Lowe's Patent Tubular and Flue Boilers; Plain Slide Valve Stationary, Hoisting, and Portable Engines. Boilers of all kinds. Steam Pumps, Mill Gearing, Shafting, &c., Silk, Tow Oakum, Bagging, Rope, Flax, and Hemp Machinery. Agents for the New Haven Manufacturing Co.'s Machinist's Tools; for Judson's Governors and Stop-Valves; Sturtevant Blowers; and Differential Pulley-Blocks WAREROOMS, 10 BARCLAY ST., NEW YORK WORKS PATERSON, NEW JERSEY.

PERFECT
NEWSPAPER FILE.

:o:

The Koch Patent File, for preserving newspapers, magazines, and pamphlets, has been recently improved and price reduced. Subscribers to the SCIENTIFIC AMERICAN can be supplied for the low price of $1.50 by mail, or $1.25 at the office of this paper. Heavy board sides; inscription, "SCIENTIFIC AMERICAN," in gilt. Necessary for every one who wishes to preserve the paper.

Address **MUNN & CO.,** Publishers "SCIENTIFIC AMERICAN."

☞ T. V. Carpenter, Advertising Agent. Address Box 773, New York city.

Machinists' Tools.

EXTRA HEAVY AND IMPROVED PATTERNS.
LUCIUS W. POND, MANUFACTURER.
Worcester, Mass.
WAREROOMS 98 LIBERTY ST., N. Y.
☞ *Lathes, Planers, Boring Mills, Drills and Gear Cutters a Specialty.*

AMERICAN TWIST DRILL CO., Woonsocket, R. I., Manufacturers of Patent DIAMOND SOLID EMERY WHEELS, EMERY WHEEL MACHINERY, and AUTOMATIC KNIFE GRINDERS. Medal and Diploma awarded by American Institute, N. Y., 1870 and 1874, also by M. C. M. A., Boston, 1874.
NEW YORK OFFICE, 15 NEW CHURCH STREET.

STANDARD BRICK MACHINE.

Made by A. M. & W. H. Wiles, Grassy Point, Rockland Co., N. Y. The Original of all Brick Machines good for anything. Send for Cuts and Price List of it, and all articles used for the manufacture of Brick.

BLAKE'S PATENT Stone and Ore Breaker

Crushes all hard and brittle substances to **any required size.** Also, any kind of STONE for ROADS and for CONCRETE, &c. Address BLAKE CRUSHER CO., New Haven, Conn.

2d hand Portable & Stationary Engines & Boilers, a half of Original Cost. BINGHAM & RICH, Oil City, Pa.

TO LUMBERMEN.

$100.00 IN GOLD.

In the Great National Sawing Contest, held in Cincinnati, Sept. 1874, *The* 100.00 *Gold Prize,* First Prize *Silver Medal* for the Best Circular Saw, and First Prize *Silver Medal* for the *Best Cross-Cut Saw,* also the two *First Prize Medals* for the *Best Saw Swage* and *Cross-Cut Saw Attachment,* were all awarded to **EMERSON, FORD & CO., of Beaver Falls, Pa.**

Their Damascus Tempered Saws, comprising their Celebrated Patent Inserted Toothed Planer, Clipper and Flange, also their superior Solid Toothed Saws of every description, are taking the lead all over the United States and Canada. ☞ Circulars, Price Lists, and Special Terms to dealers and large consumers, will be furnished free, on application; also, directions for hanging and running Saws.

GLASS OIL CUPS

of all kinds. Brass Fittings for Steam, Water and Gas. Brass Castings. Send for Catalogue. T. HOLLAND, 57 Gold St., New York.

IMPORTANT TO INVENTORS.
Having unsurpassed facilities for the manufacture and introduction of meritorious inventions, we would arrange with owners of well-secured inventions (of superior merit only) for the manufacture and general introduction of same. Address, with full explanation, MANUFACTURER, Box B, Lawrence, Mass.

Thrilling Stories.

Brilliant miscellaneous features, and pictorial embellishments unequalled every week in HEARTH AND HOME, the great illustrated weekly magazine. Price reduced to only $2.50 a year. Single copies, six cents. At news stands or by mail postage paid. Great inducements to agents and clubs. The Graphic Company, Publishers, 39–41 Park Place, New York.

IRON PLANERS,

ENGINE LATHES, DRILLS, &c. Send for Price List. NEW HAVEN MANUFACTURING CO., New Haven, Conn.

PROSPECTUS

OF THE

SCIENTIFIC AMERICAN,

FOR 1875.
THE MOST POPULAR SCIENTIFIC PAPER IN THE WORLD.

THIRTIETH YEAR.

VOLUME XXXII.—NEW SERIES.

The publishers of the SCIENTIFIC AMERICAN beg to announce that on the second day of January, 1875, a new volume commenced. It will continue to be the aim of the publishers to render the contents of the new volume more attractive and useful than any of its predecessors.

To the Mechanic and Manufacturer.

No person engaged in any of the mechanical pursuits should think of doing without the SCIENTIFIC AMERICAN. Every number contains from six to ten engravings of new machines and inventions which cannot be found in any other publication.

The SCIENTIFIC AMERICAN is devoted to the interests of Popular Science, the Mechanic Arts, Manufactures, Inventions, Agriculture, Commerce, and the industrial pursuits generally; and it is valuable and instructive not only in the Workshop and Manufactory, but also in the Household, the Library, and the Reading Room.

By the new law, the postage must be paid in advance in New York, by the publishers; and the subscriber then receives the paper by mail free of charge.

TERMS.

One copy, one year (postage included).......	$3.20
One copy, six months (postage included)....	1.60
One copy, three months (postage included)..	1.00
One copy of Scientific American for one year, and one copy of engraving, "Men of Progress"............	10.00
One copy of Scientific American for one year, and one copy of "Science Record" for 1874............	5.50

Remit by postal order, draft, or express.

Address all letters and make all Post Office orders and drafts payable to

MUNN & CO.,
37 PARK ROW, NEW YORK.

THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia and 59 Gold St., New York